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MARYLAND

DEVELOPMENT AND PROOF SERVICES

Report OCO Project No.

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DEVELOPMENT AND PROOF SERVICES
ABERDEEN PROVING GROUND
MARYLAND

AUTHORITY: ORDBG

Mr RHAllen/eh
23 January 1958

ACCURACY AND ARMOR DEFEATING EVALUATION OF SHELL, HEP, 155MM, T152E5 AND T152E6 (U)

SEVENTH REPORT ON ORDNANCE CORPS PROJECT NO. TA1-5002H

DATES OF TEST: 26, 27, 28 MARCH; 10, 11, 27 APRIL; 4 MAY; 25 JUNE 1957

ABSTRACT

OBJECTIVE

To determine and compare the accuracy, armor defeating capabilities and effective maximum range of two different designs of Shell, HEP, 155mm.

SUMMARY

A number of Shell, HEP, 155mm, inert- and Composition A-3-loaded, were fired to evaluate differences between two designs. Both designs were fired alternately for accuracy, defeat of armor, and maximum range. A comparative panel fragmentation test was conducted with the two designs and the standard HE, M107, Shell.

CONCLUSIONS

The Shell, HEP, 155mm, T152E5 is superior to Shell, HEP, 155mm, T152E6 in accuracy and armor-defeating qualities.

RECOMMENDATIONS

It is recommended that:

A. Shell, HEP, 155mm, T152E5 be considered superior to Shell, HEP, 155mm, T152E6 for the defeat of armor.

B. Consideration be given to redesign of the shell incorporating a point-detonating, mechanical time or VT fuze in combination with a base-detonating fuze for air burst against personnel, in addition to its armor-defeating qualities.

C. Additional studies be made with the T152E5 Shell for possible employment in the 155mm, M1, Gun, with respect to maximum range determination, defeat of armor and bunkers, and accuracy up to 2000 yards.

D. An evaluation of the standard M4A1 Charge be made in conjunction with the T152E5 Shell in an attempt to eliminate requirements for a special charge.

CONTENTS

I INTRODUCTION

A. Previous firing of the 155mm, HEP, Shell in the 155mm, M1, Howitzer gave indication of good band engraving with no distortion of the shell body at pressures up to 35,000 psi and an average muzzle velocity of 2300 fps. It was evident from the limited test results that a heavier shell wall as well as a positive means of sealing the base plug were needed.

B. The two designs fired in this test incorporated the desired modifications to correct the above-mentioned deficiencies. Both designs that were live-loaded were assembled with a BD, T-, Adjustable, Fuze (firing pin was adjustable) which was similar to the standard Fuze, BD, M91A1.

II DESCRIPTION OF MATERIEL

A. Shell, HEP-T, Inert-Loaded, 155mm, T152E5 with Fuze, BD, M91A1, Inert-Loaded, with Live Tracer, Lot PA-E-23878. The thickness of the shell wall was .115-inch to .170-inch at the beginning of the ogive.

B. Shell, HEP-T, Inert-Loaded, 155mm, T152E6, with Fuze, BD, M91A1, Inert-Loaded, with Live Tracer, Lot PA-E-23879. The thickness of the shell wall was .220-inch to .265-inch at the beginning of the ogive.

C. Shell, HEP, Composition A-3-Loaded, 155mm, T152E5 with Fuze, BD, T-, Adjustable, Lot PA-E-23880.

D. Shell, HEP, Composition A-3 Loaded, 155mm, T152E6 with Fuze, BD, T-, Adjustable, Lot PA-E-23881.

E. Shell, HE, TNT-Loaded, M107, with supplementary charge, with Fuze, PD, M51A5, Lot WC-31-82. This shell was used as a standard between the T152E5 and T152E6 live-loaded shell in maximum range and fragmentation tests.

F. For photographs of both shell designs with charges see Appendix C, Photograph Nos. B24565 - B24566. Also Appendix F, Drawing of Fuze and Shell.

III DETAILS OF TEST

A. PROCEDURE

1. Since the test program consisted of an evaluation between 2 shell designs, the test was divided into 4 phases. These phases were:

   a. Defeat of armor plate at 400 feet.

   b. Accuracy determination.

   c. Defeat of armor plate at 1000 yards.

   d. Maximum range and dispersion. All rounds were fired from a standard field carriage (M1A1).

2. The first phase of the test was the defeat of armor plate with live-loaded ammunition at approximately 400 feet. To accomplish this, two 8-inch armor plates were fired at, one set at 0° obliquity and the other at 60° obliquity. When it was found that the 8-inch plate at 0° obliquity could be defeated, firing at the 8-inch plate set at 60° obliquity was started. This plate could not be defeated and a 7-inch plate set at 60° obliquity was substituted. It was possible to defeat this plate. Following the plate firing, several rounds were then fired at a German "King Tiger" tank hull having 6-inch armor arranged at 44° obliquity.

3. The second phase of the test was the firing of shell of both designs inert-loaded at a 1000-yard target for the determination of accuracy. Three groups of the T152E5 design and one group of the T152E6 design were fired. During the firing for accuracy the howitzer was kept in alignment by the use of 2 transits which controlled the vertical and horizontal azimuth of the tube.

4. The third phase of the test was the setting of armor plate that was defeated at 400 feet at 1000 yards range. All shell in this phase were live-loaded. The 8-inch plate was set at 0° obliquity and the 7-inch plate at 60° obliquity. The shell designs were fired alternately to give a round-by-round comparison. A second German "King Tiger" tank hull was placed at 1300 yards from the muzzle to determine the long-range effect of the HEP shell against armor of this type.

5. The fourth phase of the test was to determine the maximum range and dispersion of both shell designs in comparison with Standard, HE, M107, 155mm Shell. All rounds were live-loaded and were fired at 45° elevation. The standard, HE, M107, Shell were fired first followed by the T152E5 and T152E6 shell.

6. In addition to the 4 phases, a panel fragmentation test was conducted utilizing 2 shell of each design and 2 standard Shell, HE, M107. A chemical and metallurgical analysis of the frontal plate of the German "King Tiger" tank hull was also conducted.

B. RESULTS

1. The firing of phase a was with live-loaded shell against armor plate at approximately 400 feet from the muzzle of the howitzer. Prior to the firing, the fuzes of 8 of the live-loaded shell, 4 each of T152E5 and T152E6 were adjusted as follows:

NUMBER ADJUSTED	SHELL	LENGTH OF PLUNGER TRAVEL(inches)
2	T152E5	.30
2	T152E5	.45
2	T152E6	.30
2	T152E6	.45

a. The adjustment was made to determine which length of fuze plunger setting would give the optimum bursting effect when used against armor plate. After setting the fuze manually, a thread setting cement similar to "Laminac" was poured on the thread of the adjusting screw and permitted to harden prior

to firing. Four of the rounds, 2 of each design, one set at .30-inch and the other at .45-inch, were then fired at a 8-inch plate set at 60° obliquity. Complete spalls resulted from all 4 shell. The remaining 4 shell were set at .30-inch and .45-inch and then fired against a similar 8-inch plate set at 60° obliquity. The hits upon this plate resulted in bulges for both shell designs. Although the bulges were of similar magnitude for both shell, 2 had partial cracks at the base. From these 8 rounds it was determined that a fuze setting of .30-inch plunger travel would produce satisfactory shell performance and all the remaining live-loaded HEP shell of both designs were set accordingly.

b. Twenty more shell, 10 each of Designs T152E5 and T152E6, were then fired alternately at the 8-inch plate set at 0° obliquity. Of the 20 rounds fired, 6 rounds functioned low order. One of the shell, Round Number Eight, functioned low order, which produced a bulge on the rear of the plate. The other 14 rounds resulted in complete spalls. Ten rounds, 5 of each design, were then fired alternately at a 7-inch plate set at 60° obliquity. All rounds functioned high order and resulted in complete spall. A German "King Tiger" tank hull which had a main front plate, 6-inches thick, set at 44° obliquity, was then fired at to determine the effect of the HEP shell against foreign armor.

c. The first shell fired, Design T152E5, resulted in a complete spall. The weight of this spall was approximately 87 pounds. See Appendix C, Photograph B-24856. The second shell, Design T152E6, also resulted in a complete spall. This spall was not weighed. The third shell, Design T152E5, struck the junction of the upper and lower glacis plate which was also 6-inches thick. Although the spall was very small compared to the others the entire weld between both plates as well as the welds in the front area were completely fractured. See Appendix C, Photograph B-24582 - B-24585.

2. The firing of phase b was conducted for accuracy determination. This firing was begun with the T152E5 shell design. Due to the target distance, it was difficult to estimate the proper elevation which would give a good hit. The first round was fired at 32 mils elevation. Five other rounds were fired dropping the elevation each time until a hit occurred. It was noted that during the first few conditioning and sensing rounds the field carriage trails moved rearward until the carriage became firmly fixed in the ground. After this there was no other perceptible movement either laterally or horizontally.

a. A 10-round series of the T152E5 shell was then fired, which gave a lateral probable error of .27 mils and a vertical probable error of .39 mils. This corrects to a vertical probable error of .13 mils if round 3 and 4 are omitted from the computations. A second 10-round series of the T152E5 shell was then fired, which resulted in a lateral probable error of .32 mils and a vertical probable error of .34 mils. A 10-round group of the T152E6 shell was then fired, which gave a lateral probable error of .34 mils and a vertical probable error of .14 mils. Following the T152E6 Shell, a 5-round group of the T152E5 shell was fired which gave a lateral probable error of .11 mils and a vertical probable error of .31 mils. The vertical probable error corrects to .09 mils if the fifth round fired is omitted from the computations. See Appendix D, Plots of Target Accuracy.

3. For the third phase, phase c, the armor plates that were defeated at approximately 400 feet were set up at 1000 yards from the muzzle of the howitzer. The first plate fired at was an 8-inch plate set at 0° obliquity. The firing was begun with a T152E5 Shell and the shell were alternated in order to compare fuze action and the degree of spalls. The first round went over the plate but the second round, a T152E6 Shell, hit. The next 3 rounds, 2 T152E5 and one T152E6, hit the plate and gave good spalls. Round Six, T152E6, hit the plate but functioned low order. The seventh round, T152E5, fell short of the plate but functioned perfectly. Upon examination to determine why the shell failed to reach the plate it was found that the jacking plate of the field carriage had sunk approximately one inch into the ground. The gun was then re-boresighted before firing. Upon firing Round Eight, T152E6, the shell struck the forward edge of the 5-inch spatter plate. See Appendix C, Photograph B22049. The round functioned high order and produced laminations on the face which were 14 inches long with a measurable center depth of 7 inches. Rounds Nine through Thirteen, 3 T152E5 and 2 T152E6 shell, gave complete back spalls on the plate. A second German "King Tiger" tank hull was placed 1300 yards from the muzzle and a T152E5 shell was fired at it. A direct hit was scored on the main front plate with a resulting 14 x 18 1/2 back spall 2 inches deep. The hit, which was high order, fractured all the welds on the main front plate as well as the welds on both sides. The hull was moved backwards 5 feet from the prefiring position. It was decided that any further firing on the hull would fail to yield useful information, as the damage was too extensive. See Appendix C, Photographs B22005-B22009, B22045-B22049, B24635-B24638.

a. A 7-inch plate was then placed at a 1000 yards from the muzzle at 60° obliquity. The bottom edge of the plate was dug into the ground and the top edge supported by an M36 Gun Motor Carriage. The first round fired, a T152E5 shell, missed the plate but the second and third rounds, T152E6 and T152E5, hit the plate. The second round struck the top edge and broke part of the plate away. The third round spalled the plate. The gun shifted on firing the fourth round and the Shell, T152E6, missed the top of the plate and impacted on the base of the turret of the M36 Gun Motor Carriage. This round functioned high order and blew the top of the turret off the carriage causing the carriage to burn with complete destruction to the motor and related components within the carriage. (See Appendix C, Photographs B24755 to B24760.) It is estimated that the turret of the M36, Motor Carriage with the extra side plates weighed approximately ten to fifteen tons.

b. Although it was questionable whether to continue firing (as the ground was soft, which permitted movement of the field mount) it was decided to continue firing. The next 3 rounds were 2 T152E5 shell and a T152E6 which functioned high order. Rounds Five and Seven failed to give complete spalls, but the bulges of both rounds had cracks that partially encircled the base. Round Six gave a complete spall. Round Eight, a T152E6 shell, hit adjacent to Round Six and was low order and no bulge or spall resulted. Round Nine, a T152E5 shell, impacted high order in the vicinity of Round Seven and did not bulge or spall. It is believed that the previous hits on the plate where either bulges or spalls occurred caused that area of the plate to be laminated and the next hit in the vicinity of the laminations absorbed part of the shock wave. It was found that in some of the spalls on this plate that small flat pieces of the plate could be picked out and other pieces of the plate inside

the spalled area could be moved. (See Appendix C, Photograph B25726.) Rounds Ten, Eleven and Twelve, 2 T152E6 and one T152E5 shell, gave satisfactory back spalls on the plate. The size of the spalls on this plate were smaller than those previously encountered, but the charpy value of 103.77 - 91:46 for the plate was much higher than on previous plates fired. (See Appendix C, Photographs B-24755-60 and B25724-26.)

4. In the fourth phase, for maximum range and dispersion, all rounds were live-loaded and fired at 45° elevation. The first rounds fired were a group of 10-rounds Shell, HE, M107, which were assembled with a standard point-detonating fuze. This group was followed by 12 rounds of T152E5 shell and 8 rounds of T152E6 shell. The results of this firing were:

	MUZZLE VELOCITY(fps)		RANGE (yards)		TIME OF FLIGHT (sec.)	
PROJECTILE	AVERAGE	STD. DEV.	AVERAGE	STD. DEV.	AVERAGE	STD. DEV.
M107	1837	6.36	15918	59.71	59.50	0.58
T152E5	1829	2.94	11302	95.14	52.23	0.57
T152E6	1831	3.70	11865	57.52	53.20	0.20

5. A chemical and metallurgical analysis of a section of the "King Tiger" main frontal plate was made. It was determined that the plate was of relatively poor quality and therefore, the armor was ineffective against this type of round. (See Appendix E, Metallurgical Report No. 57-P-45.)

6. The preliminary results of the panel fragmentation test show a high degree of fragmentation with high velocity from the nose and side spray of both shell. In an evaluation of the size of fragments and the velocities of both HEP shell and the HE, M107, the T152E5 design was superior. It is felt that the T152E5 shell might be modified to incorporate a point-detonating, mechanical time or VT fuze which would make the shell suitable for airburst against either unsheltered or poorly sheltered personnel. A fuze of the above-mentioned type could be assembled to the shell by means of a standard adapter ring mounted internally as the forward end of the ogive. A dummy fuze with a suitable nose pad could be assembled to the shell if it was desired to have HEP action. A base-detonating fuze would remain as an integral part of the shell. Considerable production time and cost would be saved as the current operation for the construction and manufacture of the nose of the HEP shell requires several operations.

7. Since the number of rounds of both shell designs were limited in quantity, further evaluation of the shell was restricted. Had the supply been adequate, it would have been advantageous to compare the velocity and range of both shell designs with the HE, M107 in firing with the standard M4A1, Zone 7 Charge. However, it was calculated from the results of the range firing phase that the T152E5 and E6 shell if used with the M4A1 charge would give the following increase in velocity and range:

PROJECTILE				
TYPE	WEIGHT (lbs)	EXPECTED MUZZLE VELOCITY (fps)	EXPECTED PRESSURE psi/100	EXPECTED RANGE (yards)
T152E5	71.0	2151	241	14,052
T152E6	78.0	2051	251	13,705

8. Copies of the panel fragmentation report with the firing record will be distributed at a later date.

IV CONCLUSIONS

It is concluded that:

The Shell, HEP, 155mm, T152E5 is superior to Shell, HEP, 155mm, T152E6 in accuracy and armor-defeating qualities.

V RECOMMENDATIONS

It is recommended that:

A. Shell, HEP, 155mm, T152E5 be considered superior to Shell, HEP, 155mm, T152E6 for the defeat of armor.

B. Consideration be given to redesign of the shell incorporating a point-detonating, mechanical time or VT fuze in combination with a base-detonating fuze for air burst against personnel, in addition to its armor-defeating qualities.

C. Additional studies be made with the T152E5 Shell for possible employment in the 155mm, M1, Gun, with respect to maximum range determination, defeat of armor and bunkers, and accuracy up to 2000 yards.

D. An evaluation of the standard M4A1 Charge be made in conjunction with the T152E5 Shell in an attempt to eliminate requirements for a special charge.

SUBMITTED:

Ralph H. Allen
RALPH H. ALLEN
Proof Director

REVIEWED:

H. B. Anderson
H. B. ANDERSON
Chief, Artillery
Ammunition Branch

H. A. Bechtol
H. A. BECHTOL
Chief, Artillery Division

APPROVED:

H. A. Noble
H. A. NOBLE
Assistant to the Deputy Director
for Engineering Testing
Development and Proof Services

APPENDICES

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ORDNANCE CORPS
PICATINNY ARSENAL
DOVER, NEW JERSEY

APPENDIX A

Mr. T.Clifford/bjb/2269

FEB 1 1 '57 -11 AM

IN REPLY REFER TO:
ORDBB-TE5 470 (741-8003 H) 155 mm

SUBJECT: Test Program Request Nr. TE-20, Accuracy and Armor Defeating Evaluation of Shell, HEP, 155mm, T152E5 and T152E6 (U)

TO: Commanding General
Aberdeen Proving Ground
Aberdeen, Maryland
ATTENTION: ORDBG-DP-TA (Mr. H. B. Anderson)

ordbg e) 471/46

1. Inclosed is Test Program Request Nr. TE-20, D/A Priority 1B, for testing of 135 subject shell. These shell with bagged propelling charges, the description of which is furnished in the inclosed Test Program Request, are scheduled for shipment to your Proving Ground during the week of 28 January 1957. Ammunition Data Cards Nrs. 83332, 83333, 83334, and 83335, in triplicate, covering the subject shell and Drawing P-87758, dated 12 September 1955, in duplicate, covering the Fuze, BD, T-, Adjustable, used in the Composition A-3 loaded shell, are inclosed for your information and file.

2. Funding Data:

Funds are available under Sub-Project Order Number 70405530-01-10201-01, and Job Order Number 3039-99-901.

3. Coordination:

a. OCO - ORDTA

b. APG - Artillery Ammunition Branch, ORDBG-DP-TA

c. Picatinny Arsenal - Engineer primarily responsible for the test is Mr. T. Clifford, phone: Picatinny Arsenal, Extension 2269.

15251

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ORDBB-TE5
SUBJECT: Test Program Request Nr. TE-20, Accuracy and Armor Defeating Evaluation of Shell, HEP, 155mm, T152E5 and T152E6 (U)

4. Notification for Test Attendance:

Mr. T. Clifford will attend the test, and requests notice three days prior to the firing.

FOR THE COMMANDER:

R. H. Wood

R. H. WOOD
Assistant

6 Incls
1. TPR Nr. TE-20 (C) (six copies)
2-5. Ammo Data Cards Nrs. 83332, 83333, 83334, 83335 (in Trip)
6. Dwg. P-87758 (in Dupe)

CC
OCO-ORDTA w/Incls 1-6
Chamberlain Corporation w/Incl 1
100 Mildred Street
Waterloo, Iowa
APG-Comptrollers Office

Mr. T. Clifford/bjb/2269
Test Program Request Nr. TE-20(C)
(Job Order Nr. 3039-99-901)
Picatinny Arsenal, Dover, N. J.
29 January 1957

1. Material for Test:

a. 34 each Shell, HEP-T, Inert-Loaded, 155mm, T152E5, with Fuze, BD, M91A1, Inert-Loaded with Live Tracer, Lot PA-E-23878.

b. 11 each Shell, HEP-T, Inert-Loaded, 155mm, T152E6, with Fuze, BD, M91A1, Inert-Loaded with Live Tracer, Lot PA-E-23879.

c. 48 each Shell, HEP, Comp A-3 Loaded, 155mm, T152E5, with Fuze, BD, T-, Adjustable, Lot PA-E-23880.

d. 42 each Shell, HEP, Comp A-3 Loaded, 155mm, T152E6, with Fuze, BD, T-, Adjustable, Lot PA-E-23881.

e. 82 each Charge, Propelling, T-, for 155mm Howitzer, Projectile, HEP, T152E5, Lot PA-E-24685.

f. 53 each Charge, Propelling, T-, for 155mm Howitzer, Projectile, HEP, T152E6, Lot PA-E-24684.

2. Project Authority:

a. Ordnance Project Number TA1-5002H.

b. Department of the Army Number 5A04-01-001.

c. Funds available under Sub-Project Order Number 70405530-01-10201-01, and Job Order Number indicated above.

d. D/A Priority 1B.

3. Object of Development or Experiment:

To compare the accuracy and armor defeating capabilities of 155mm, T152E5 HEP Shell (Thin Wall), with T152E6 HEP Shell (Heavy Wall), and to ascertain optimum fuze functioning time for both shell by use of the Fuze, BD, T-, Adjustable.

Test Program Request Nr. TE-20 (C) (Cont)

4. History Sketch:

On 2 June 1954, the following 155mm, T152E4 HEP Shell were fired from the 155mm Howitzer, M1, at Aberdeen Proving Ground in accordance with TPR-3672:

a. Three shell for recovery at an average chamber pressure of 34,600 PSI and an average muzzle velocity of 2300 fps, range 9500 yards. Recovered shell indicated good band engraving and no distortion.

b. Four shell against 7" thick armor plate of 64 ft.lbs. Charpy impact value at -40°F, resulting in hinged spalls.

On 8 June 1954, the following five 155mm, T152E4 HEP Shell were fired against 7" thick armor plate with a Charpy impact value of 45 to 48 ft.lbs. at -40°F from the 155mm, T80 Gun at Aberdeen Proving Ground, in accordance with TPR-3672:

Nr. 1 - Hit and destroyed velocity coil.

Nr. 2 - Velocity 1148 fps, plate at 0° - Spalled.

Nr. 3 - Velocity 1489 fps, plate at 0° - Spalled.

Nr. 4 - Velocity 1496 fps, plate at 60° - Spalled.

Nr. 5 - Velocity 1231 fps, plate at 60° - Spalled.

The limited results of the above tests appeared to indicate the necessity of controlled mechanical properties in target plates if valid test results are to be expected, and that additional explosive confinement, by means of heavier shell walls, would increase the terminal effectiveness, as had been the case in previous experiments with other caliber shell.

The T152E5 Shell submitted for test under this TPR are similar to the T152E4, with the exception that the flanged base plug and flat copper gasket of the -E4 have been changed to a base plug with a caulking groove and a copper and lead caulked gas check. Weight of empty metal parts for the T152E5 is 38.1 to 38.6 lbs.; weight of charge is 25.7 to 26.1 lbs.; as fired weight is 69.78 to 70.44 lbs.

The T152E6 is similar to the -E5 Model, with the exception of a heavier side wall and ogive. Weight of empty metal

Test Program Request Nr. TE-20 (C) (Cont)

parts for the T152E6 is 47.3 to 48.6 lbs.; weight of charge is 23.6 to 24.4 lbs.; as fired weight is 77 to 78.3 lbs.

5. Description in Detail of Improvements Made Since Last Proving Ground Test:

Both the -E5 and -E6 Model shell have a new base plug and a caulked copper and lead gas check, described under the History Sketch. This type of base closure has a greater degree of safety than the flat gasket type, since it will effectively maintain its seal against higher chamber pressures.

Both the -E5 and -E6 Shell, Lots PA-E-23880 and -23881 are assembled with Fuze, BD, T-, Adjustable, Drawing P-87758, dated 12 September 1955. Functioning time of these fuzes may be adjusted in the field by setting the length of firing pin travel from .030" to .210", in accordance with instructions contained in Drawing P-87758, Notes D and E.

Propellant charges have been established for both -E5 and -E6 Model shell at this Arsenal. These charges will produce 1850 fps muzzle velocity at an approximate chamber pressure of 30,000 PSI and will be supplied, ready for use, with the shell.

6. Local Tests:

Propellant charge establishment with uniform velocity series firings for both T152E5 and T152E6 Shell has been conducted at this Arsenal during December 1956, using the 155mm Howitzer, M1.

7. Object of Test:

To determine and compare the accuracy, armor defeating capabilities and optimum fuze functioning time for 155mm T152E5 and -E6 HEP Shell.

8. Precautions in Handling and Testing:

The usual precautions in handling and testing of HE loaded experimental 155mm HEP Shell assembled with experimental fuzes should be followed. The Fuze, BD, T-, Adjustable, contains all the safety features of the standard Fuze, BD, M91A1; however, there is a very remote possibility of gas leakage through the adjusting screw threads at the rear of the fuze and

Test Program Request Nr. TE-20 (C) (Cont)

since this fuze has not previously been used with ammunition fired from a weapon, appropriate safety precautions should be taken.

9. Recommended Test Program:

Fire all shell from the 155mm Howitzer, M1, using the propelling charges supplied. Resultant muzzle velocity of 1850 fps is similar to that of the M107 HE Shell fired with Zone 7 Charge.

a. Fire three groups of ten each Shell, T152E5, Inert-Loaded, Lot PA-E-23878 (total 30) against an accuracy target approximately 16 feet square at 1000-yard range. Record muzzle velocity, chamber pressure, time of flight, and accuracy. Photograph target after each group of ten rounds. The four remaining inert T152E5 Shell of Lot PA-E-23878 may be used as warmers and spotting rounds.

b. Fire one group of ten Shell, T152E6, Inert-Loaded, Lot PA-E-23879, against an accuracy target approximately 16 feet square at 1000-yard range. Record muzzle velocity, chamber pressure, time of flight and accuracy. Photograph target. The one remaining inert T152E6 Shell of Lot PA-E-23879 may be used as a warmer and spotting round.

c. Fire 30 Shell, T152E5, Comp A-3 Loaded, Lot PA-E-23880, and 30 Shell, T152E6, Comp A-3 Loaded, Lot PA-E-23881, against armor plate of specified thickness and obliquity, having a Charpy impact value of 35 to 50 ft.lbs., at -40°F at an approximate range of 100 yards.

Shell, HEP, T152E5, Lot PA-E-23880

Nr. Shell	Plate Thickness	Obliquity
5	8"	0°
5	7"	0°
5	6"	0°
5	8"	60°
5	7"	60°
5	6"	60°

Test Program Request Nr. TE-20 (C) (Cont)

Shell, HEP, T152E6, Lot PA-E-23881

Nr. Shell	Plate Thickness	Obliquity
5	8"	0°
5	7"	0°
5	6"	0°
5	8"	60°
5	7"	60°
5	6"	60°

When plate of a specified thickness and obliquity is defeated by a series of five shell, five additional confirming shell will be fired against the same plate, and firings against thinner plates at the same obliquity cancelled. Record the following data for each shell:

(1) Muzzle velocity

(2) Striking velocity

(3) Facial impression dimensions

(4) Spall size, weight and velocity

(5) Recover and photograph spalls

(6) Photograph front and back of target plate

(7) Photograph one each T152E5 and -E6 Shell with propelling charge prior to firing.

Setting of fuze functioning time for Comp A-3 Loaded shell will be demonstrated by Picatinny Arsenal representative who will furnish thread sealing cement specified on Drawing P-87758. Prints of this drawing, in duplicate, will be supplied the Proving Ground.

Shell must be conditioned at a minimum temperature of 70°F prior and during application of thread sealing compound.

Test Program Request Nr. TE-20 (C) (Cont)

The following tools will be required for fuze setting:

(1) Micrometer Depth Gage

(2) Heavy screw driver

(3) 1-1/8" open-end or adjustable wrench

(4) Strap wrench or vise suitable to hold 155mm Shell body.

d. Fire ten Shell, T152E5, Comp A-3 Loaded, Lot PA-E-23880, and ten Shell, T152E6, Comp A-3 Loaded, Lot PA-E-23881, against the thickest plate defeated at 60° obliquity under phase c, at a range of 1000 yards and 60° obliquity.

Record muzzle velocity, facial impression dimensions and spall size for each shell. Calculate striking velocity for each shell. Recover and photograph spalls and back and front of target plate. Still photographs of shell striking target will be required, with camera at or near weapon position.

e. Composition A-3 Loaded shell of Lots PA-E-23880 and -23881 remaining after completion of phases c and d should be fired against an armored vehicle hull at an approximate range of 100 yards. A report of damage with photographs will be required. Still photographs of shell striking target will also be required, with camera at or near weapon position.

10. References:

a. Letter, OCO to PA, ORDBB 471.14/975-139, 16 Sep 50.

b. OCM-34159, 10 April 1952.

c. Test Program Request Nr. 3672, dated 13 April 1953.

Test Program Request Nr. TE-20 (C) (Cont)

11. Report Distribution:

a. Test Report security classification - Confidential.

b. 1 Copy - OCO - ORDTA
1 Copy - APG - ORDBG-DP-TA
1 Copy - Chamberlain Corporation
5 Copies - Picatinny Arsenal:

1 Copy - ATTN: Inspection Division
1 Copy - ATTN: ORDBB-TE5
1 Copy - ATTN: ORDBB-TE8
1 Copy - ATTN: Propellant & Explosive Lab
1 Copy - ATTN: Fuze Development Lab

D. R. BEEMAN
Acting Director
Samuel Feltman Ammunition Labs

J. E. RAINIER
Assistant

CONFIDENTIAL

ARMY-P.A. DOVER, N.J. ORDBB-43 7-28-58 800 Woodhull 2269 **EXPERIMENTAL AMMUNITION DATA CARD** 1957 NO. 83332

T. P. R. NO.	KIND				AMM. LOT NO.
SPEC. NO.	Shell, HEP-T, Inert Loaded, 155MM, T152E5 With Fuze, BD, M91A1 Inert Loaded With Live Tracer				PA-E-23878
					QUANTITY IN LOT: 48
DRG. NO.: None	DRG. DATE OR REV.	ALLOT. ADVICE	PROJECT NO.: TA1-50024	RAD OR EPO NO.	QUANTITY IN SHIPMENT
P. A. X. O.: 629-176	PROP. CHARGE	EXPECTED M. V.	EXPECTED PRESSURE	ASSEMBLED BY: PA	DATE OF ASSEMBLY: September, 1956

REMARKS: Packed: 1 Shell/wood box -saddle pack.
*Filler Inert: 65% Borax, 30% K_2SO_4, 5% Graphite.

Shell ring gaged 100%. Empty weight of Shell 37.22 lbs. min., 38.63 lbs. max. Weight of loaded and drilled shell 67.35 lbs min., [illegible] lbs Max., "As Fired" weight of Shell 70.10 min., 70.40 max.

COMPONENT	MPTS Assy	Fuze M91A1		*Filler			
KIND	155MM	BD, Inert		Inert			
	T152E5	With Live Tracer					
DRG. NO.	J7577-441	73-2-239			REGRADING DATA	CANNOT BE PREDETERMINED	
DRG. DATE OR REV.	8-28-54	1-30-53					
MFG'D BY	Chamberlain	PA		PA			
DATE	1955	1956		1956			
LOT NO.	YCC-1153	PA-E-23981		None			

PREPARED BY F. Puccio, Ars Opers DIVISION

CERTIFIED TO BY: W. Knapp, INSPECTOR, Inspection DIVISION

PICATINNY ARSENAL, DOVER, NEW JERSEY

ARMY-P.A. DOVER, N.J. ORDBB-43 10-10-55 100 Woodhull 2269 **EXPERIMENTAL AMMUNITION DATA CARD** NO. 83333

T. P. R. NO.	KIND				AMM. LOT NO.
SPEC. NO.	Shell, HEP-T, Inert Loaded, 155MM, T152E6 With Fuze, BD, M91A1 Inert Loaded With Live Tracer				PA-E-23879
					QUANTITY IN LOT: 20
DRG. NO.: None	DRG. DATE OR REV.	ALLOT. ADVICE	PROJECT NO.: TA1-5002H	RAD OR EPO NO.	QUANTITY IN SHIPMENT
P. A. X. O.: 629-176	PROP. CHARGE	EXPECTED M. V.	EXPECTED PRESSURE	ASSEMBLED BY: PA	DATE OF ASSEMBLY: September, 1956

REMARKS: Packed: 1 Shell/wood box - saddle pack.
*Filler Inert: 65% Borax, 30% K_2SO_4, 5% Graphite. Shell ring gaged 100%. Empty wt of shell 47.52 lbs min, 48.45 lbs max. Wt of loaded and drilled shell [illegible] lbs min, 72.86 lbs max. "As fired" wt of shell [illegible] lbs min, [illegible] lbs max.

COMPONENT	MPTS Assy	Fuze BD		*Filler			
KIND	155MM	M91A1 Inert		Inert			
	T152E6	With Live Tracer					
DRG. NO.	J7577-599	73-2-239					
DRG. DATE OR REV.	6-1-55	1-30-53					
MFG'D BY	Chamberlain	PA		PA			
DATE	1955	1956		1956			
LOT NO.	YCC-1307	PA-E-23981		none			

PREPARED BY F. Puccio, Ars Opers DIVISION

CERTIFIED TO BY: W. Kishpaugh, INSPECTOR, Inspection DIVISION

PICATINNY ARSENAL, DOVER, NEW JERSEY

CONFIDENTIAL

ARMY-P.A. DOVER, N.J.
ORDBB-43 10-10-55 100

Woodhull 2269 **EXPERIMENTAL AMMUNITION DATA CARD** Incl 4 'ordbg ⊙ 471/46 1957

NO. 83334

T.P.R. NO.	KIND				AMM. LOT NO.
	Shell, HEP, Comp A-3 Loaded, 155MM T152E5 with Fuze BD, T-Adjustable				PA-E-23880
SPEC. NO.					QUANTITY IN LOT: 48
DRG. NO.	DRG. DATE OR REV.	ALLOT. ADVICE	PROJECT NO.	RAD OR EPO NO.	QUANTITY IN SHIPMENT
None			TA1-5002H		
P.A.X.O.	PROP. CHARGE	EXPECTED M.V.	EXPECTED PRESSURE	ASSEMBLED BY	DATE OF ASSEMBLY
629-176				PA	September 1956

CONFIDENTIAL

REMARKS: Packed: 1 Shell/wood box, saddle pack.
Empty wt of shell [illegible] lbs min, [illegible] lbs max. Wt of charge [illegible] lbs min, 26.11 lbs max.
Avg specific gravity of charge [illegible] loaded wt. "As Fired" [illegible] lbs min [illegible] lbs max.
Shell press loaded using [illegible] tons (8000 PSI). Shell x-rayed and ring gaged 100%,
Adjustable fuze set so perc plg travel is .210 (Firing pin to Detonator).

COMPONENT	MPTS Assy	Fuze BD	Filler				
KIND	155MM T152E5	T-Adjustable	Comp. A-3 Spec				
DRG. NO.	J7577-441	P-87758	JAN-C-440				
DRG. DATE OR REV.	8-28-54	9-12-55	1-31-47				
MFG'D BY	Chamberlain	PA	Wabash Ord				
DATE	1955	1956	1954				
LOT NO.	YCC-1153	PA-E-23909	WAB-13-411				

REGRADING DATA CANNOT BE PREDETERMINED

PREPARED BY F. Puccio — Ars Opers DIVISION

CERTIFIED TO BY: W. Kishpaugh, INSPECTOR — Inspection DIVISION

PICATINNY ARSENAL 341
DOVER, NEW JERSEY

CONFIDENTIAL

ARMY-P.A. DOVER, N.J.
ORDBB-43 10-10-55 100

Woodhull 2269 **EXPERIMENTAL AMMUNITION DATA CARD** Incl 5 'ordbg ⊙ 471/46

NO. 83335

T.P.R. NO.	KIND				AMM. LOT NO.
	Shell, HEP, Comp. A-3, Loaded, 155MM, T152E6 With Fuze BD, T-Adjustable				PA-E-23881
SPEC. NO.					QUANTITY IN LOT: 42
DRG. NO.	DRG. DATE OR REV.	ALLOT. ADVICE	PROJECT NO.	RAD OR EPO NO.	QUANTITY IN SHIPMENT
None			TA1-5002H		
P.A.X.O.	PROP. CHARGE	EXPECTED M.V.	EXPECTED PRESSURE	ASSEMBLED BY	DATE OF ASSEMBLY
629-176				PA	September, 1956

REMARKS: Packed: 1 Shell/wood box. Saddle pack.
Empty wt of shell 47.18 lbs min, [illegible] lbs max. Wt of charge 23.63 lbs min, 24.37 lbs max.
Avg specific gravity of charge [illegible] .10cm loaded wt "As fired" [illegible] lbs min, [illegible] lbs
max. Shell press loaded using [illegible] tons (8000 psi). Shell x-rayed and ring gaged 100%.
Adjustable fuze set so Perc Plg Travel is .210 (Firing Pin to Detonator).

COMPONENT	MPTS Assy	Fuze BD	Filler				
KIND	155MM T152E6	T-Adjustable	Comp A-3 Spec				
DRG. NO.	J7577-599	P-87758	JANC-440				
DRG. DATE OR REV.	6-1-55	9-12-55	1-31-47				
MFG'D BY	Chamberlain	PA	Wabash Ord				
DATE	1955	1956	1954				
LOT NO.	YCC-1307	PA-E-23909	WAB-13-411				

REGRADING DATA CANNOT BE PREDETERMINED

PREPARED BY F Puccio — Ars Opers DIVISION

CERTIFIED TO BY: W. Kishpaugh, INSPECTOR — Inspection DIVISION

PICATINNY ARSENAL 341
DOVER, NEW JERSEY

CONFIDENTIAL

ORDNANCE CORPS
PICATINNY ARSENAL
DOVER, NEW JERSEY

APPENDIX A

Mr. T. Clifford/bjb/2269

IN REPLY
REFER TO:
SAMUEL FELTMAN AMMUNITION LABORATORIES
ORDBG-TE5

SUBJECT: TPR TE-20, Shell, 155 mm, HEP, T152E5 and -E6

TO: Commanding General
Aberdeen Proving Ground
Aberdeen, Maryland
ATTENTION: ORDBG-DP-TA (Mr. H. Anderson)

The following data, pertaining to the subject TPR, are inclosed for your information and files:

a. Lists of shell weights for Ammunition Lot Numbers PA-E-23878, 23879, 23880 and 23881 (7 sheets). NOTE: Column marked "Complete Weight" is that of shell as fired.

b. Ammunition Data Cards Numbers 84429 and 84430, in triplicate, pertaining to propelling charges for the subject TPR.

FOR THE COMMANDER:

J. E. RAINIER
Assistant

J. E. Rainier

6 Incls
1-4 List of shell weights for Lots PA-E-23878, 23879, 23880, 23881
5-6 Ammunition Data Cards Numbers 84429, 84430 (in trip)

Sept 1956
XO-629-176
Lot PA-E-23878

**Shell, HEP-T, inert-loaded, 155mm,
T152E5 with Fuze, BD, M91A1, inert-loaded**

SHELL NO	EMPTY WT	WT AFTER DRILLING	COMPLETE WT
1	38.50 lbs	64.88 lbs	70.53 lbs
2	38.52	64.85	70.52
3	38.35	64.53	70.20
4	38.34	64.35	70.10
5	38.59	64.90	70.59
6	38.46	65.12	70.80
7	38.47	64.90	70.60
8	38.38	64.91	70.57
9	38.41	64.84	70.60
10	38.60	64.97	70.67
11	38.52	65.16	70.80
12	38.63	65.03	70.73
13	38.49	64.85	70.56
14	38.58	65.22	70.90
15	38.62	65.09	70.81
16	38.38	64.62	70.30
17	38.58	64.64	70.33
18	38.55	65.01	70.72
19	38.42	64.90	70.52
20	38.56	65.16	70.80
21	38.44	64.90	70.62
22	38.32	64.94	70.70
23	38.32	64.79	70.45
24	38.55	64.96	70.72
25	38.33	64.75	70.65
26	38.44	65.04	70.40
27	38.58	65.10	70.77
28	38.43	64.96	70.45
29	38.57	65.15	70.85
30	38.54	65.03	70.82
31	38.52	65.02	70.67
32	38.61	65.07	70.75
34	38.60	64.87	70.58
35	38.43	64.71	70.44
36	38.44	64.90	70.63
37	38.37	64.80	70.58
38	38.52	64.98	70.71
39	38.45	64.88	70.58
40	38.47	64.76	70.47
41	38.45	65.07	70.70
42	38.43	64.81	70.49

Lot PA-E-23878

SHELL NO	EMPTY WT	WT AFTER DRILLING	COMPLETE WT
43	38.50	65.02	70.69
44	38.45	64.79	70.54
45	38.48	64.80	70.55
46	38.60	64.89	70.60
47	38.60	64.93	70.59
48	38.46	64.97	70.90
49	38.45	64.90	70.52

XO-629-176

Shell HEP inert-loaded 155mm, T152E6
with Fuze BD, M91A1 inert-loaded with live Tracer
Lot PA-E-23879

SHELL NO	EMPTY WT	LOADED WT	COMPLETE WT
1	47.56	72.02	77.70
35	47.82	72.11	77.87
55	47.02	71.35	77.07
19	47.83	72.24	77.97
46	47.10	71.46	77.17
2	48.45	72.86	78.55
43	47.94	72.24	77.85
60	47.05	71.33	77.10
5	48.23	72.53	78.32
7	48.32	72.80	78.56
57	47.48	71.71	77.38
34	48.01	72.42	78.22
30	48.12	72.50	78.33
4	48.24	72.43	78.18
62	48.08	72.45	78.08
40	48.28	72.54	78.31
52	46.79	71.02	76.77
8	48.40	72.72	78.49
49	48.11	72.42	78.21
61	47.29	71.66	77.50

Sept 1956
XO-629-176
Lot PA-E-23880

Shell, HEP, Comp A3 loaded, 155mm, T152E5
with Fuze BD, T - Adjustable

SHELL NO	EMPTY WT	EMPTY SHELL WITH WATER WT	WT AFTER DRILLING	WT AFTER DRILLING WITH WATER	WT OF CHARGE	COMPLETE WT	DENS
1	38.57		64.35		25.78	70.28	
2	38.25	55.28	64.07	65.14	25.82	69.99	1.617
3	38.64	55.68	64.45	65.68	25.81	70.37	1.632
4	38.53		64.55		26.02	70.25	
5	38.53		64.40		25.87	70.35	
6	38.59		64.37		25.78	70.25	
7	38.54		64.61		26.07	70.32	
8	38.46		64.47		26.01	70.15	
9	38.55		64.41		25.86	70.29	
10	38.10	55.21	63.93	64.99	25.83	69.78	1.609
11	38.36	55.41	64.37	65.46	26.01	70.03	1.629
12	38.46	55.46	64.49	65.60	26.03	70.16	1.638
13	38.41		64.19		25.78	70.21	
14	38.37		64.19		25.82	70.10	
15	38.35		64.35		26.00	70.08	
16	38.59		64.48		25.89	70.44	
17	38.50		64.48		25.98	70.13	
18	38.43		64.30		25.87	70.18	
19	38.41		64.34		25.93	70.16	
20	38.50		64.39		25.89	70.28	
21	38.49		64.32		25.83	70.14	
22	38.46		64.32		25.86	70.22	
23	38.23	55.33	64.00	65.05	26.77	69.86	1.605
24	38.51	55.60	64.59	65.69	26.08	70.26	1.631
25	38.40	55.47	64.40	65.50	26.00	70.15	1.629
26	38.54		64.65		26.11	70.29	
27	38.45		64.15		25.70	70.06	
28	38.26		64.14		25.88	70.03	
29	38.49		64.21		25.72	70.07	
30	38.49		64.20		25.71	70.00	
31	38.56		64.36		25.80	70.28	
32	38.51		64.27		25.76	70.15	
33	38.55		64.26		25.71	70.12	
34	38.31		64.05		25.74	70.00	
35	38.42		64.21		25.79	70.32	
36	38.55		64.27		25.72	70.19	
37	38.62	55.65	64.40	65.46	25.78	70.12	1.614
38	38.51		64.24		25.73	70.17	
39	38.48		64.20		25.72	70.10	
40	38.53		64.36		25.83	70.26	

Lot PA-E-23880

SHELL NO	EMPTY WT	EMPTY SHELL WITH WATER WT	WT AFTER DRILLING	WT AFTER DRILLING WITH WATER	WT OF CHARGE	COMPLETE WT	DENS
41	38.41		64.27		25.86	70.16	
42	38.49		64.23		25.74	70.06	
43	38.56		64.27		25.73	70.22	
44	38.59	55.57	64.60	65.73	26.01	70.32	1.641
45	38.56		64.31		25.75	70.20	
46	38.46		64.26		25.80	70.12	
47	38.42		64.12		25.70	70.04	
48	38.30		64.05		25.75	70.00	

Sept 1956
XO-629-176
Lot PA-E-23881

SHEET 1 of 1

Shell, HEP, Comp A3 loaded, 155mm, T152E6 with Fuze, BD, T - Adjustable

SHELL NO	EMPTY WT	EMPTY SHELL WITH WATER	WT AFTER DRILLING	WT AFTER DRILLING WITH WATER	WT OF CHARGE	COMPLETE WT	DENS
3	47.97		71.69		23.72	77.55	
6	48.25		72.15		23.90	77.84	
9	48.57	64.42	72.53	73.40	23.96	78.23	1.600
10	47.97		71.81		23.84	77.71	
11	48.48	64.15	72.15	73.13	23.75	78.12	1.607
12	48.22		72.01		23.79	77.92	
13	47.93		71.56		23.63	77.62	
14	47.93		71.86		23.93	77.62	
15	47.72		71.82		24.10	77.69	
16	48.30		72.25		23.95	77.97	
17	48.24		72.13		23.89	77.79	
18	48.13		72.19		24.06	77.92	
20	48.09		71.92		23.83	77.71	
21	48.30		72.08		23.78	77.91	
22	47.28	63.12	71.67	72.76	24.39	77.06	1.65
23	48.25		72.20		23.95	77.93	
24	48.07		71.88		23.81	77.82	
25	48.14		71.85		23.71	77.82	
26	48.29		72.05		23.76	78.00	
27	48.25		71.90		23.65	77.89	
28	47.80		71.80		24.00	77.54	
29	48.18		72.15		23.97	77.95	
31	48.24		71.97		23.73	77.87	
32	48.09		72.02		23.93	77.78	
33	48.37	64.12	72.15	73.19	23.78	78.28	1.61
36	48.12		72.09		23.97	77.91	
37	48.00		71.65		23.65	77.73	
38	48.06		71.88		23.82	77.55	
39	48.12		72.05		23.93	77.75	
41	48.31		72.23		23.92	77.96	
42	47.97		71.68		23.71	77.68	
44	48.23		72.20		23.97	77.97	
45	48.12		72.18		24.06	77.84	
47	47.83		71.70		23.87	77.48	
48	47.94		71.72		23.78	77.63	
50	47.29	63.09	71.63	72.72	24.34	77.02	1.65
51	48.07		71.81		23.74	77.65	
53	47.75		71.60		23.85	77.29	
54	47.98		71.90		23.92	77.62	
56	47.39	63.18	71.23	72.31	23.84	77.02	1.62
58	47.78		71.74		23.96	77.59	
59	48.25		72.15		23.90	77.84	

ARMY-P.A. DOVER, N.J. ORDER-43 7-26-56 500 Baumann 5184

EXPERIMENTAL AMMUNITION DATA CARD

NO. 84429

T. P. R. NO.	KIND				AMM. LOT NO.
	Charge, Propelling, T- For 155MM Howitzer, Projectile HEP-T152E6				PA-E-24684
SPEC. NO.					QUANTITY IN LOT 53
DRG. NO.	DRG. DATE OR REV.	ALLOT. ADVICE	PROJECT NO. TA1-5002H	RAD OR EPO NO.	QUANTITY IN SHIPMENT
P. A. X. O. 629-176	PROP. CHARGE 9 lbs 15 ozs	EXPECTED M. V.	EXPECTED PRESSURE	ASSEMBLED BY PA	DATE OF ASSEMBLY January, 1957

REMARKS: Packed: Improvised, in M10A1 Cartridge storage case.
Igniter Pads fabricated in accordance with Dwg's 71-9-180, Rev. 3-19-45, Dwg. 71-9-181, Rev. 10-25-51 and Dwg. 71-9-182, Rev. 3-19-45.
Charge Bag, dimensions: 5¼" diameter, 15" long. Charge weight each 9 lbs. 15 ozs.

COMPONENT	Cloth Silk	Cloth Silk	Propellent	Black			
KIND	Ctg Bag Class "E"	Ctg. Bag Class "C"	M1	Powder Gr. A1			
DRG. NO.							
DRG. DATE OR REV.							
MFG'D BY	Susquehanna	Unk	Indiana	King Pwd Depot			
DATE	Unk	Unk	1943	12-8-53			
LOT NO.	SMI-15	Unk	IND-6667	KPD-1-61			

PREPARED BY L. Koza, Ars Opers DIVISION

CERTIFIED TO BY: F. Holloway, Inspection DIVISION

PICATINNY ARSENAL 454 DOVER, NEW JERSEY

ARMY-P.A. DOVER, N.J. ORDER-43 7-26-56 500 Baumann 5184

EXPERIMENTAL AMMUNITION DATA CARD

NO. 84430

T. P. R. NO.	KIND				AMM LOT NO.
	Charge, Propelling T- For 155MM Howitzer, Projectile, HEP, T152E5				PA-E-24685
SPEC NO.					QUANTITY IN LOT 82
DRG. NO.	DRG. DATE OR REV.	ALLOT. ADVICE	PROJECT NO. TA1-5002H	RAD OR EPO NO.	QUANTITY IN SHIPMENT
P. A. X. O. 629-176	PROP. CHARGE 9 lbs 5 ozs.	EXPECTED M. V.	EXPECTED PRESSURE	ASSEMBLED BY PA	DATE OF ASSEMBLY January, 1957

REMARKS: Packed: Improvised, in M10A1 Cartridge storage case.
Igniter pads fabricated in accordance with Dwg's 71-9-180, Rev. 3-19-45, Dwg. 71-9-181, Rev. 10-25-51 and Dwg. 71-9-182, Rev. 3-19-45.
Charge Bag dimensions: 5¼" diameter, 14" long. Charge weight each 9 lbs. 5 ozs.

COMPONENT	Cloth Silk	Cloth Silk	Propellent	Black			
KIND	Ctg Bag Class "E"	Ctg Bag Class "C"	M1	Powder Gr. A-1			
DRG. NO.							
DRG. DATE OR REV.							
MFG'D BY	Susquenanna	Unk	DuPont	King Pwd Depot			
DATE	Unk	Unk	1941	12-8-53			
LOT NO.	SMI-15	Unk	CPX-4394	KPD-1-61			

PREPARED BY L. Koza, Ars Opers DIVISION

CERTIFIED TO BY: F. Holloway, Inspection DIVISION

PICATINNY ARSENAL 454 DOVER, NEW JERSEY

JOINT MESSAGEFORM	SECURITY CLASSIFICATION: UNCLASSIFIED

SPACE BELOW RESERVED FOR COMMUNICATION CENTER

PRECEDENCE	TYPE MSG (Check)			ACCOUNTING SYMBOL	ORIG. OR REFERS TO	CLASSIFICATION OR REFERENCE
ACTION MAIL	BOOK	MULTI	SINGLE			
INFO			X			

FROM:

CO PICATINNY ARSENAL DOVER NJ

TO:

COMMANDING GENERAL
ABERDEEN PROVING GROUND
MARYLAND
ATTN: ORDBG-DPS-AA (MR. ALLEN)

INFO: CHAMBERLAIN CORP., 100 MILDRED ST., WATERLOO, IOWA
ATTENTION: MR. I. HERMAN (MAIL)

1. IT IS REQUESTED THAT TEST PROGRAM REQUEST NO. TE-20 BE AMENDED AS FOLLOWS:

A. CONDUCT COMPARATIVE PANEL FRAGMENTATION TESTS OF TWO EACH T152E5 AND T152E6, 155 MM SHELL WITH TWO M107 STANDARD HE SHELL.

B. THE REMAINING T152 SHELL (TWELVE -E5 AND EIGHT -E6) SHOULD BE FIRED FROM THE M1 HOWITZER FOR COMPARATIVE MAXIMUM RANGE AND DISPERSION WITH TEN M107 STANDARD HE SHELL.

C. COMPLETE PHOTOGRAPHIC COVERAGE, INCLUDING SOUND OF FIRING AND SHELL DETONATION, IS REQUIRED, ALSO, COMPLETE CHEMICAL ANALYSIS AND MECHANICAL PROPERTIES OF KING TIGER TANK FACE PLATE.

SPECIAL INSTRUCTIONS

DATE	TIME
MAY 15 57	-4 PM
MONTH	YEAR

WRITER	
SYMBOL	ORDBB-TE5 A-19
TYPED NAME AND TITLE (Signature, if required)	Mr. T. Clifford/sjm
PHONE	2269
PAGE NR.	1
NR. OF PAGES	2

JOINT MESSAGEFORM

SECURITY CLASSIFICATION: UNCLASSIFIED

SPACE BELOW RESERVED FOR COMMUNICATION CENTER

PRECEDENCE	TYPE MSG (Check)			ACCOUNTING SYMBOL	ORIG. OR REFERS TO	CLASSIFICATION OR REFERENCE
	BOOK	MULTI	SINGLE			
ACTION MAIL						
INFO						

FROM: CO PICATINNY ARSENAL DOVER NJ

TO: ABERDEEN PROVING GROUND

SPECIAL INSTRUCTIONS

2. NOTIFICATION OF TIME OF TEST IS REQUESTED SO THAT A REPRESENTATIVE MAY ATTEND.

3. THE M107 HE SHELL ARE TO BE SUPPLIED BY YOUR PROVING GROUND.

4. A COST ESTIMATE IS REQUIRED. COST OF AMENDMENT IS TO BE CHARGED TO SUB-PROJECT ORDER NO. 70405530-01-10201-02 AND JOB ORDER NO. 3039-99-901.

DATE	TIME
MONTH	YEAR

WRITER

SYMBOL: ORDBB-TE5

TYPED NAME AND TITLE (Signature, if required): Mr. T. Clifford/sjm

PHONE: 2269 | PAGE NR.: 2 | NR. OF PAGES: 2

SECURITY CLASSIFICATION: UNCLASSIFIED

RELEASER

SIGNATURE: R. H. Wood

TYPED (or stamped) NAME AND TITLE:

R. H. WOOD
Assistant

DD FORM 1 MAY 58 173 REPLACES DD FORM 173 1 OCT 48, WHICH IS OBSOLETE FOR ARMY USE.

A-20

☆ U. S. GOVERNMENT PRINTING OFFICE: 1958—O-347894

DEVELOPMENT AND PROOF SERVICES
ABERDEEN PROVING GROUND, MARYLAND
FIRING RECORD

APPENDIX B

OBJECT OF TEST: Accuracy and Armor Defeating Evaluation of Shell, HEP, 155mm, T152E5 and T152E6

DATES OF TEST: 27 Mar thru 25 Jun 1957
FIRING RECORD NO.: P-62648
SHEET 1 OF 6
AUTHORITY: ORDBG-TE5
c) 471/46, TPR No. TE-20
Messageform ORDBG, 471/417
W.O. NO.: 332-236-54 eh

DEVELOPMENT: ORDTA
PROJECT NO.: TA1-5002H
PRIORITY: 1B

MATERIEL

For Accuracy and Plate Firing

Howitzer: 155mm, M1, No. 7.
Carriage: 155mm, M1A1, No. 497.
Recoil Mechanism: 155mm, M6, No. 3089.

For Range Firing

Howitzer: 155mm, M1, No. 2199.
Carriage: 155mm, M1A1, No. 497.
Recoil Mechanism: 155mm, M6, No. 3089.

AMMUNITION COMPONENTS

1. Shell, HEP-T, Inert-Loaded, 155mm, T152E5, w/Fuze, BD, M91A1, Inert-Loaded, w/Live Tracer, Lot No. PA-E-23878.
2. Shell, HEP-T, Inert-Loaded, 155mm, T152E6, w/Fuze, BD, M91A1, Inert-Loaded, w/Live Tracer, Lot No. PA-E-23879.
3. Shell, HEP, Comp A-3-Loaded, 155mm, T152E5, w/Fuze, BD, T-Adjustable, Lot No. PA-E-23880.
4. Shell, HEP, Comp A-3-Loaded, 155mm, T152E6, w/Fuze, BD, T-Adjustable, Lot PA-E-23881.
5. Shell, HE, TNT-Loaded, M107, w/supplementary charge, w/Fuze, PD, M51A5, Lot No. WC-31-82.
6. Charge, Propelling, T-, for 155mm Howitzer, Projectile, HEP, T152E5, Lot No. PA-E-24685.
7. Charge, Propelling, T-, for 155mm Howitzer, Projectile, HEP, T152E6, Lot No. PA-E-24684.
8. Charge, Propelling, M4A1, for 155mm Howitzer, Projectile, HE, M107, Lot No. RAD-19612-45.
9. Primer, Percussion, Mk2A4, 19 grains, Lot No. PA-6-47.

COIL DISTANCES

ROUNDS	26 March	
1-4	Muzzle to 1st Coil	49.32 feet
	Between Coils	75.0 feet

COIL DISTANCES (Contd.)

ROUNDS		
5-8	Muzzle to 1st Coil	51.0 feet
	Between Coils	73.24 feet
	27 March	
All rounds	Muzzle to 1st Coil	53.25 feet
	Between Coils	72.0 feet
	28 March	
1-4	Muzzle to 1st Coil	54.30 feet
	Between Coils	70.50 feet
5 & 6	Muzzle to 1st Coil	54.41 feet
	Between Coils	70.90 feet
7-14	Muzzle to 1st Coil	54.32 feet
	Between Coils	76.1 feet
15-17	Muzzle to 1st Coil	54.76 feet
	Between Coils	70.20 feet
	10 April	
All rounds	Muzzle to 1st Coil	53.7 feet
	Between Coils	60.34 feet
	11 April	
All rounds	Muzzle to 1st Coil	50.57 feet
	Between Coils	60.8 feet
	27 April	
All rounds	Muzzle to 1st Coil	51.4 feet
	Between Coils	48.96 feet
	4 May	
All rounds	Muzzle to 1st Coil	49.47 feet
	Between Coils	50.04 feet
	25 June	
All rounds	Muzzle to 1st Coil	79.28 feet
	Between Coils	29.98 feet

PRESSURE GAGE DESCRIPTION

Type of Gage: Medium Caliber (M3) Copper Cup
Crusher Cylinder: Copper metal of 1955, annealed 1956, Lot 7-C
Position in Tube: One on each side of charge.

ARMOR PLATE DATA

PLATE NO.	CHARPY @ -40°F.	BRINELL TOP	BRINELL BOTTOM
	8-INCH PLATE 120" X 120"		
070960	71.71	225	248
14073	62.00/81.00	241	241
	7-INCH PLATE 120" X 120"		
14001-2	103.77/91.46	235	232
14063-1	57.00/34.00	229	229

ROUND-BY-ROUND DATA OF PLATE FIRING AT 400 FEET

FIRING RECORD NO. P-62648
SHEET 3 OF 6

DATE FIRED (1957)	TUBE RD. NO.	RD. NO.	PROJECTILE TEST RD. NO.	PROJECTILE TYPE	PROJECTILE WEIGHT (lbs.)	INSTRUMENT VELOCITY (fps)	STRIKING VELOCITY (fps)	CHAMBER PRESSURE psi/100	SPALL VELOCITY (fps)	DIA. OF PLATE (in.)	DEGREE OF OBLIQUITY	TYPE OF SPALL	MEASUREMENT OF SPALL FRONT (in.) HOR.	FRONT VERT.	FRONT DEPTH	REAR (in.) HOR.	REAR VERT.	REAR DEPTH	TIME OF FLIGHT (sec.)
26 Mar	4508	1	25	85	71.0	1815	1786	277	436	8	0	Complete	12 3/16	x 11	x 2	11	x 10 1/2	x 1 3/4	.20073
	4509	2	15	85	71.0	1827	1798	278	422	8	0	Complete	12	x 12 3/4	x 13/16	11 1/2	x 12 1/8	x 3/4	.20002
	4510	3	58	86	78.5	1850	1824	319	432	8	0	Complete	13	x 14	x 15/16	12 1/2	x 12 3/8	x 2	.19611
	4511	4	22	86	78.0	1865	1838	310	None	8	0	Complete	13	x 14	x 7/8	12 5/8	x 12 1/2	x 1 3/4	.19566
	4512	5	54	86	78.5	1826	1800	321	None	8	60	None-Bulge	10	x 12	x 7/8		--		Not taken
	4513	6	32	86	78.0	1838	1812	315	None	8	60	None-Bulge	11	x 12	x 3/4		--		Not taken
	4514	7	20	85	71.0	1852	1823	277	None	8	60	Partial	16	x 13	x 3/4		--		Not taken
	4515	8	30	85	71.0	1882	1853	288	None	8	60	Partial	14 1/2	x 12 1/2	x 3/4		--		Not taken
27 Mar	4516	1	36	86	75.5	1824	1797	313	436	8	0	None		--			--		.19447
	4517	2	32	85	71.5	1824	1796	284	322	8	0	Complete	13	x 12	x 1	12 1/2	x 11 9/16	x 2	.19552
	4518	3	27	86	78.5	1830	1804	303	447	8	0	Complete	13 1/4	x 14	x 7/8	13	x 13	x 1 3/4	.19464
	4519	4	31	85	71.5	1828	1800	298	None	8	0	None		--			--		.19531
	4520	5	39	86	78.5	1830	1804	291	None	8	0	None		--			--		.19522
	4521	6	46	85	71.5	1827	1799	279	466	8	0	Complete	13	x 11	x 3/4	12 1/2	x 11	x 1 5/8	.19817
	4522	7	24	86	78.5	1837	1811	306	Not taken	8	0	Complete	11	x 12	x 1	13 1/4	x 11 1/2	x 2	Not taken
	4523	8	13	85	71.5	1831	1803	286	Not taken	8	0	None		--			--		Not taken
	4524	9	79	86	78.5	1840	1814	306	Not taken	6	0	Complete	11	x 10	x 3/4	12 3/4	x 9	x 1 1/2	Not taken
	4525	10	37	85	71.0	1842	1813	289	Not taken	8	0	None		--			--		Not taken
	4526	11	26	86	78.5	1842	1816	301	Not taken	8	0	Complete	12	x 12	x 3/4	12 3/4	x 12 1/2	x 2	Not taken
	4527	12	2	85	71.0	1841	1812	289	Not taken	8	0	Complete	10	x 11	x 1/2	12	x 12	x 2	Not taken
	4528	13	45	86	78.5	1848	1822	310	Not taken	8	0	Complete	11	x 11	x 1	11	x 10 1/2	x 2 3/8	Not taken
	4529	14	21	85	71.0	1839	1810	288	Not taken	8	0	Complete	12	x 11	x 1	8	x 9 1/2	x 1 1/2	Not taken
	4530	15	51	86	78.5	1855	1829	312	Not taken	8	0	Complete	12	x 10	x 3/4	13	x 12	x 3/4	Not taken
	4531	16	41	85	71.0	1845	1816	279	Not taken	6	0	None		--			--		Not taken
28 Mar	4532	1	26	85	71.5	1955	1926	285	Not taken	8	0	Complete	11	x 11 1/2	x 1 1/4	10	x 9	x 2 1/4	
	4533	2	50	86	78.0	1973	1946	307	Not taken	8	0	Complete	11	x 12 1/4	x 1 1/2	14	x 14	x 3 1/4	
	4534	3	43	85	71.0	1966	1937	313	Not taken	8	0	Complete	13	x 12	x 1 1/2	12	x 10 1/2	x 2 1/4	
	4535	4	15	86	78.5	1967	1940	306	Not taken	8	0	Complete	13	x 12 1/2	x 1 1/2	9 1/4	x 9	x 2 1/8	
	4536	5	17	85	70.5	1796	1772	282	471	7	60	Complete	16	x 13 1/2	x 1 1/8	13 1/2	x 11 1/2	x 3	
	4537	6	23	86	78.5	1801	1799	305	395	7	60	Complete	11	x 15	x 1 1/2	13	x 11 1/2	x 2 3/4	
	4538	7	23	85	70.5	1824	1799	278	370	7	60	Complete	12	x 16	x 3/4	11 3/4	x 9 1/2	x 1 3/4	
	4539	8	9	86	79.0	1834	1810	291	Not taken	7	60	Complete	12	x 16	x 1 1/4	14 1/2	x 10 1/2	x 2	
	4540	9	11	85	70.5	1848	1821	279	Not taken	7	60	Complete	11	x 15	x 1	14	x 9 1/2	x 2 1/4	
	4541	10	25	86	78.5	1855	1831	291	Not taken	7	60	Complete	11	x 16	x 1 1/2	13 1/4	x 10 1/4	x 2 1/8	
	4542	11	5	85	70.5	1853	1826	283	Not taken	7	60	Complete	12	x 15	x 1 1/4	15	x 10	x 2 1/2	
	4543	12	1	86	78.5	1878	1853	297	Not taken	7	60	Complete	11	x 16	x 1 1/8	14 1/2	x 11	x 2 1/2	
	4544	13	29	85	70.5	1910	1882	289	419	7	60	Complete	12	x 16	x 1 1/4	15 3/4	x 11 1/2	x 2 1/2	
	4545	14	13	86	78.5	1915	1890	282	Not taken	7	60	Complete	12	x 16	x 1 1/8	13 3/4	x 12 1/2	x 2 3/4	
	4546	15	16	85	70.5	[illegible] 7	1882	286	781	6	44	Complete	12	x 15	x 7/8	19	x 22	x 2 3/4	
	4547	16	56	86	78.0	1915	1890	290	Not taken	6	44	Complete	14	x 13	x 1	19	x 15	x 2 1/4	
	4548	17	47	85	70.5	1923	1897	286	Not taken	6	44	Complete	6	x 6 1/4	x 7/8	9 1/4	x 5 1/8	x 2	

ACCURACY ROUND-BY-ROUND FIRING DATA

TUBE RD. NO.	TEST RD. NO.		PROJECTILE RD. NO.	TYPE	WEIGHT (lbs.)	INSTRUMENT VELOCITY (fps)	CHAMBER PRESS. psi/100	ELEVATION mils	TARGET MEAS. (in.) VERT.	HOR.	TIME OF FLIGHT (sec.)
10 April											
4549	34	*	A	E5	70.50	Not taken	291	32			
4550	11	*	B	E5	70.91	Not taken	294	28			
4551	44	*	C	E5	70.49	Not taken	293	26			
4552	36	*	D	E5	70.56	Not taken	293	24			
4553	31	*	E	E5	70.71	Not taken	296	22			
4554	1	*	F	E5	70.53	Not taken	293	18			
4555	39	*	G	E5	70.57	Not taken	287	18			
4556	7		1	E5	70.59	1804	282	18	∠26 1/2	∠21	1.80366
4557	3		2	E5	70.20	1810	281	18	∠26 1/2	∠24	1.79962
4558	48		3	E5	70.66	1805	284	18	-17 1/2	∠31	1.80115
4559	38		4	E5	70.69	1806	290	18	-27 1/2	∠21	1.80276
4560	4		5	E5	70.07	1812	285	18	∠15	-9	1.79531
4561	34		6	E5	70.57	1803	291	18	∠26 1/2	∠2	1.80983
4562	32		7	E5	70.73	1806	289	18	∠17 1/2	∠4 1/2	1.80254
4563	8		8	E5	70.59	1808	289	18	∠23	∠6	Lost
4564	10		9	E5	70.68	1803	286	18	∠18	∠7 1/2	1.80988
4565	27		10	E5	70.75	1809	290	18	∠37 1/2	-12 1/2	1.80170
4566	35		1	E5	70.45	1808	280	18	∠27 1/2	-6 1/2	1.80223
4567	9		2	E5	70.56	1809	288	18	∠54	-36	1.80150
4568	26		3	E5	70.45	1817	290	18	∠22 1/2	-18	1.79374
4569	19		4	E5	70.57	1817	303	18	∠41 1/2	-27 1/2	1.79220
4570	22		5	E5	70.66	1810	294	18	∠35 1/2	-3 1/2	1.79830
4571	49		6	E5	70.47	1812	291	18	∠ 3 1/2	-45	1.79729
4572	17		7	E5	70.34	1816	298	18	∠16 1/2	-51	1.79370
4573	40		8	E5	70.57	1808	286	18	∠43 1/2	-42	1.80150
4574	47		9	E5	70.56	1813	287	18	∠27 1/4	-47	1.79880
4575	20		10	E5	70.55	1811	287	18	∠64	-35	1.79993
4576	46		1	E6	77.16	1827	314	18	-49 1/2	-62 1/2	1.76341
4577	49		2	E6	78.15	1819	315	18	-33 1/2	-12	1.77006
4578	1		3	E6	77.71	1824	316	18	-40 1/2	∠13	1.76532
4579	62		4	E6	78.12	1826	318	18	-26	-3 1/2	1.76278
4580	52		5	E6	76.80	1835	307	18	-41	-6 1/2	1.75500
4581	30		6	E6	78.24	1821	316	18	-34	-50 1/2	1.76988
4582	57		7	E6	77.37	1830	309	18	-33	-25	1.75801
4583	5		8	E6	78.23	1821	308	18	-17	-17	1.76939
4584	60		9	E6	77.06	1834	308	18	-28	-19 1/2	1.75622
4585	34		10	E6	78.18	1817	316	18	-39	-32 1/2	1.77089
4586	8		11	E6	78.44	1817	308	18	-38	-35	1.77285
11 April											
4587	20	*	H	E5	70.83	1811	290	18	∠17	∠18 1/2	1.79972
4588	30	*	I	E5	70.74	1807	293	18	∠2 1/2	0	1.80328
4589	24		1	E5	70.69	1810	294	18	∠23	∠2	1.79820
4590	13		2	E5	70.79	1809	294	18	∠11	∠18	1.80071
4591	46		3	E5	70.59	1807	294	18	∠19 1/2	∠9 1/2	1.80211
4592	12		4	E5	70.48	1812	294	18	∠17	∠8	1.79637
4593	45		5	E5	70.59	1805	286	18	-18	∠13	1.80523

* Conditioning Rds.

ROUND-BY-ROUND DATA OF PLATE FIRING 1000 YARDS

FIRING RECORD NO. P-62648
SHEET 5 OF 6

DATE FIRED	TUBE RD. NO.	TEST RD. NO.	PROJECTILE RD. NO.	PROJECTILE TYPE	PROJECTILE WEIGHT (lbs.)	VELOCITY (fps) INSTRUMENT	VELOCITY (fps) STRIKING	VELOCITY (fps) SPALL	CHAMBER PRESSURE psi/100	DIA. OF PLATE (in.)	DEGREE OF OBLIQUITY	TYPE OF SPALL	MEASUREMENT OF SPALL FRONT (in.) VERT.	FRONT (in.) DEPTH	FRONT (in.) HOR.	REAR (in.) VERT.	REAR (in.) DEPTH	REAR (in.) HOR.
27 Apr	4594	42	1	E5	71.0	1815	Missed plate		289	8	0	--	--	--	--	--	--	--
	4595	44	2	E6	78.5	1819	681		319	8	0	Complete	12	1 1/4	12 1/2	12	2 1/4	12
	4596	44	3	E5	71.5	1820	682		296	8	0	Complete	13 1/2	1	13	13	2 1/2	13
	4597	33	4	E6	78.5	1819	585		329	8	0	Complete	13	1	12	13	2 1/2	13
	4598	4	5	E5	71.0	1820	723		322	8	0	Complete	12	3/4	13	13 1/4	2 1/4	12
	4599	42	6	E6	78.9	1825	Low order		314	8	0	None	--	--	--	--	--	--
	4600	7	7	E5	71.0	1823	Fell short		300	8	0	--	--	--	--	--	--	--
	4601	11	8	E6	78.5	1829	Hit base of plate		305	8	0	--	--	--	--	--	--	--
	4602	38	9	E5	71.0	1823	Lost		303	8	0	Complete	13	3/4	13 1/4	13 1/2	1 3/4	13 1/4
	4603	41	10	E6	78.5	1820	644		298	8	0	Complete	13	3/4	13 1/4	13	2	11 1/2
	4604	39	11	E5	71.0	1824	985		299	8	0	Complete	12	3/4	13 1/2	12 1/2	1 3/4	13
	4605	14	12	E6	78.0	1821	Not taken		298	8	0	Complete	12	3/4	12	10 1/2	2	11 1/2
	4606	8	13	E5	71.0	1823	Not taken		291	6	44	Complete	14	1 1/4	12	18 1/2	2	14
4 May	4607	23	1	E5	70.5	1810	Not taken		290	7	60	Missed plate	--	--	--	--	--	--
	4608	16	2	E6	78.0	1818	Not taken		296	7	60	Complete	15	3/4	13	10	1 3/4	11 1/2
	4609	37	3	E5	71.0	1820	Not taken		301	7	60	Complete	16	3/4	16	11	2	8
	4610	21	4	E6	78.5	1818	Not taken		307	7	60	Hit base of turret						
	4611	6	5	E5	71.0	1811	Not taken		303	7	60	Partial	15	3/4	12	8	1 3/4	7 1/2
	4612	17	6	E6	78.15	Lost	Not taken		299	7	60	Complete	15 1/2	3/4	12 1/2	8	2 1/2	9
	4613	14	7	E5	71.0	1817	Not taken		302	7	60	Partial	15	3/4	12	340° cracked bulge		
	4614	31	8	E6	78.5	1823	Low order		301	7	60	None						
	4615	33	9	E5	71.0	1818	Low order		298	7	60	None				Impacted between Rds. 3 & 7.		
	4616	28	10	E6	78.5	1823	Low order		295	7	60	Complete	15	3/4	12	10	2	8 3/4
	4617	9	11	E5	71.0	1812	Low order		301	7	60	Complete	15	3/4	11 1/2	10 1/2	2	9
	4618	47	12	E6	78.0	1824	Low order		303	7	60	None	13	3/4	9	Impacted between Rds. 6 & 8.		

MAXIMUM RANGE AND DISPERSION ROUND-BY-ROUND DATA - TUBE NO. 2199

TUBE RD. NO.	PROJECTILE TYPE	PROJECTILE WEIGHT (lbs.)	CHARGE LOT	MUZZLE PRESS. psi/100	MUZZLE VELOCITY (fps)	DEFLECTIONS mils	DEFLECTIONS yards	MEAS. RANGE yards	TIME OF FLIGHT (sec.)	ORDER OF DETONATION
1183	M107	95.1	M4A1	312	1839	21.9	344	16036	59.75	HO
1184	M107	95.1	M4A1	305	1836	22.4	349	15917	59.54	HO
1185	M107	95.1	M4A1	313	1835	21.9	342	15944	59.55	HO
1186	M107	95.1	M4A1	326	1843	20.6	321	15909	59.56	HO
1187	M107	95.1	M4A1	316	1842	21.0	329	15971	59.52	HO
1188	M107	95.1	M4A1	314	1842	21.5	333	15810	59.37	HO
1189	M107	95.1	M4A1	323	1827	21.9	341	15879	59.46	HO
1190	M107	95.1	M4A1	322	1842	22.6	352	15887	59.58	HO
1191	M107	95.1	M4A1	318	1836	22.7	354	15931	59.55	HO
1192	M107	95.1	M4A1	310	1825	21.2	330	15901	59.17	HO
1193	T152E5	71.0	PA-E-24685	326	1827	41.3	455	11252	52.38	HO
1194	T152E5	71.0	PA-E-24685	318	1829	40.0	446	11365	52.45	HO
1195	T152E5	71.0	PA-E-24685	314	1830	40.5	450	11338	52.18	HO
1196	T152E5	71.0	PA-E-24685	319	1826	41.3	459	11332	52.33	HO
1197	T152E5	71.0	PA-E-24685	324	1828	39.6	442	11400	52.11	HO
1198	T152E5	70.5	PA-E-24685	322	1826	40.3	447	11307	52.05	HO
1199	T152E5	71.0	PA-E-24685	323	1828	42.4	463	11150	52.12	HO
1200	T152E5	71.0	PA-E-24685	320	1825	41.6	463	11350	52.18	HO
1201	T152E5	71.0	PA-E-24685	304	1823	42.9	472	11223	52.19	HO
1202	T152E5	70.5	PA-E-24685	315	1827	42.5	465	11159	52.01	HO
1203	T152E5	71.0	PA-E-24685	314	1829	41.9	463	11277	52.21	HO
1204	T152E5	70.5	PA-E-24685	321	1835	36.7	413	11471	52.58	Failed
1205	T152E6	78.5	PA-E-24684	296	1834	41.0	476	11852	53.30	HO
1206	T152E6	78.5	PA-E-24684	313	1824	42.6	493	11818	53.10	HO
1207	T152E6	78.5	PA-E-24684	293	1831	42.4	490	11803	53.14	HO
1208	T152E6	78.5	PA-E-24684	299	1828	41.3	481	11873	53.13	HO
1209	T152E6	78.0	PA-E-24684	301	1829	42.2	489	11833	53.21	HO
1210	T152E6	78.0	PA-E-24684	302	1834	40.7	477	11969	53.20	HO
1211	T152E6	78.0	PA-E-24684	304	1835	44.3	514	11839	53.20	HO
1212	T152E6	78.5	PA-E-24684	307	1830	42.6	498	11931	53.30	HO

NOTE: Deflection measured to right of line of fire. Range measure from muzzle to point of impact. HO = High Order

This firing record forms a part of the Seventh Report on Ordnance Corps Project No. TA1-5002H.

APPROVED:

H. A. BECHTOL
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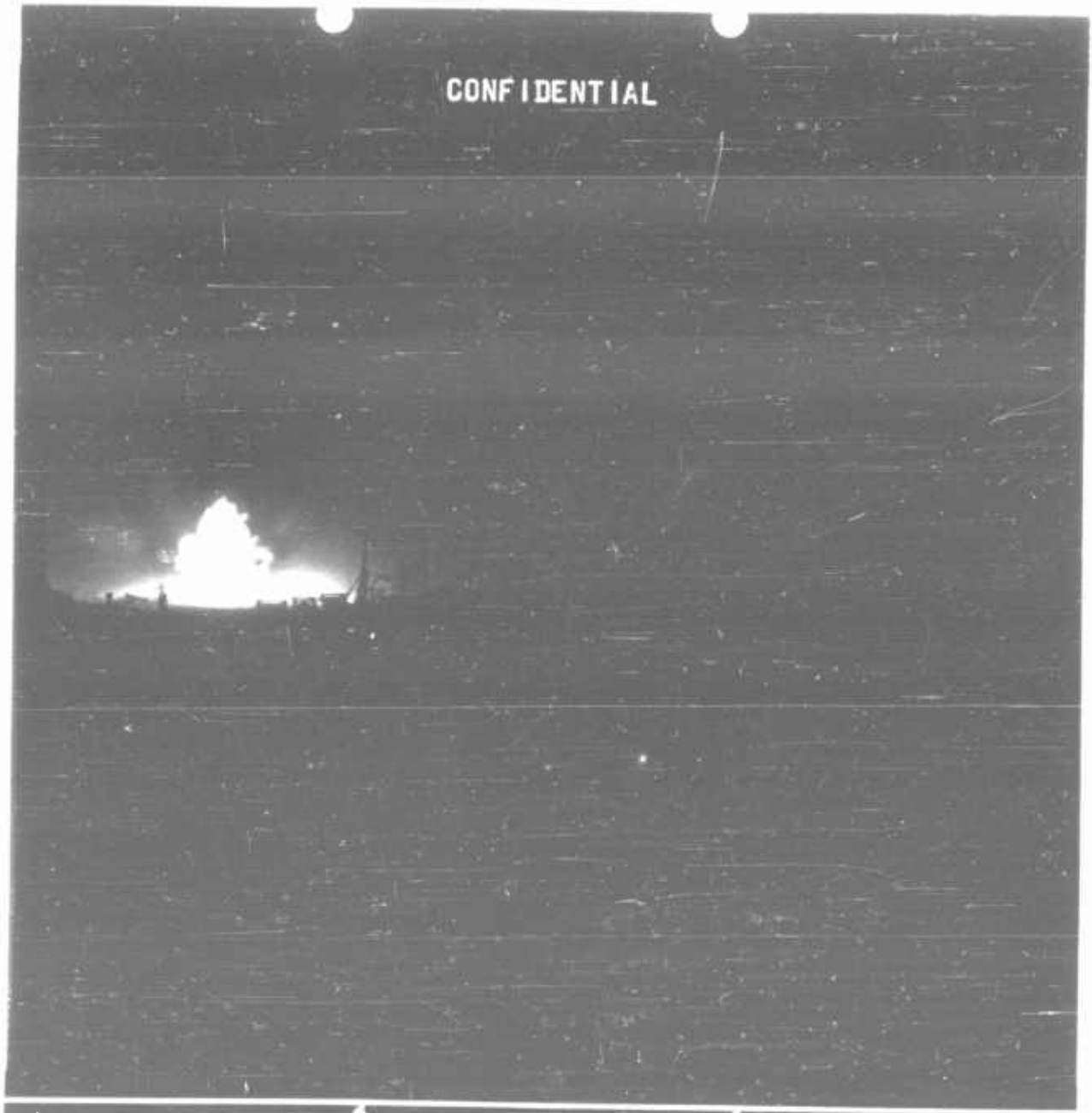
Proof Director

420Pn CONFIDENTIAL ABERDEEN PROVING GROUND 28 March 1957

Project No. TA1-5002H/TE20. Accuracy and Armor Defeating Evaluation of Shell, HEP, 155mm.

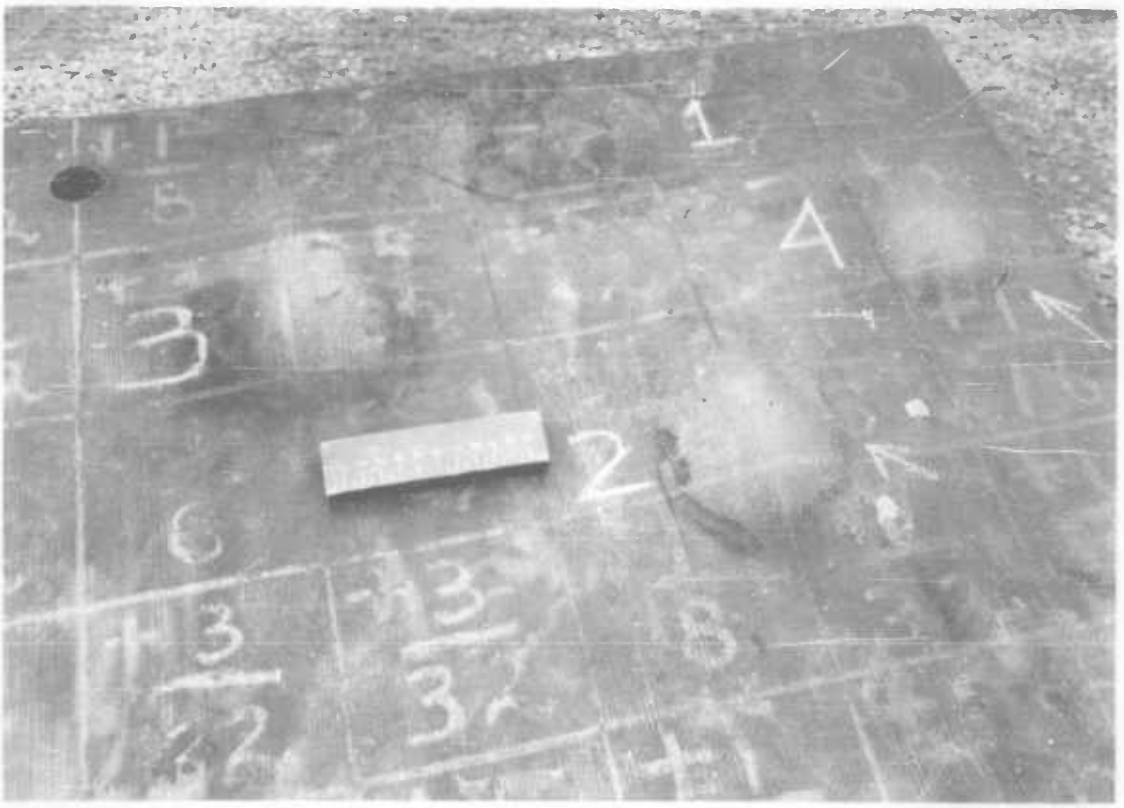
Open shutter photograph of Shell, HEP, 155mm, T152E6, striking 7 inch plate at 60 degrees obliquity.



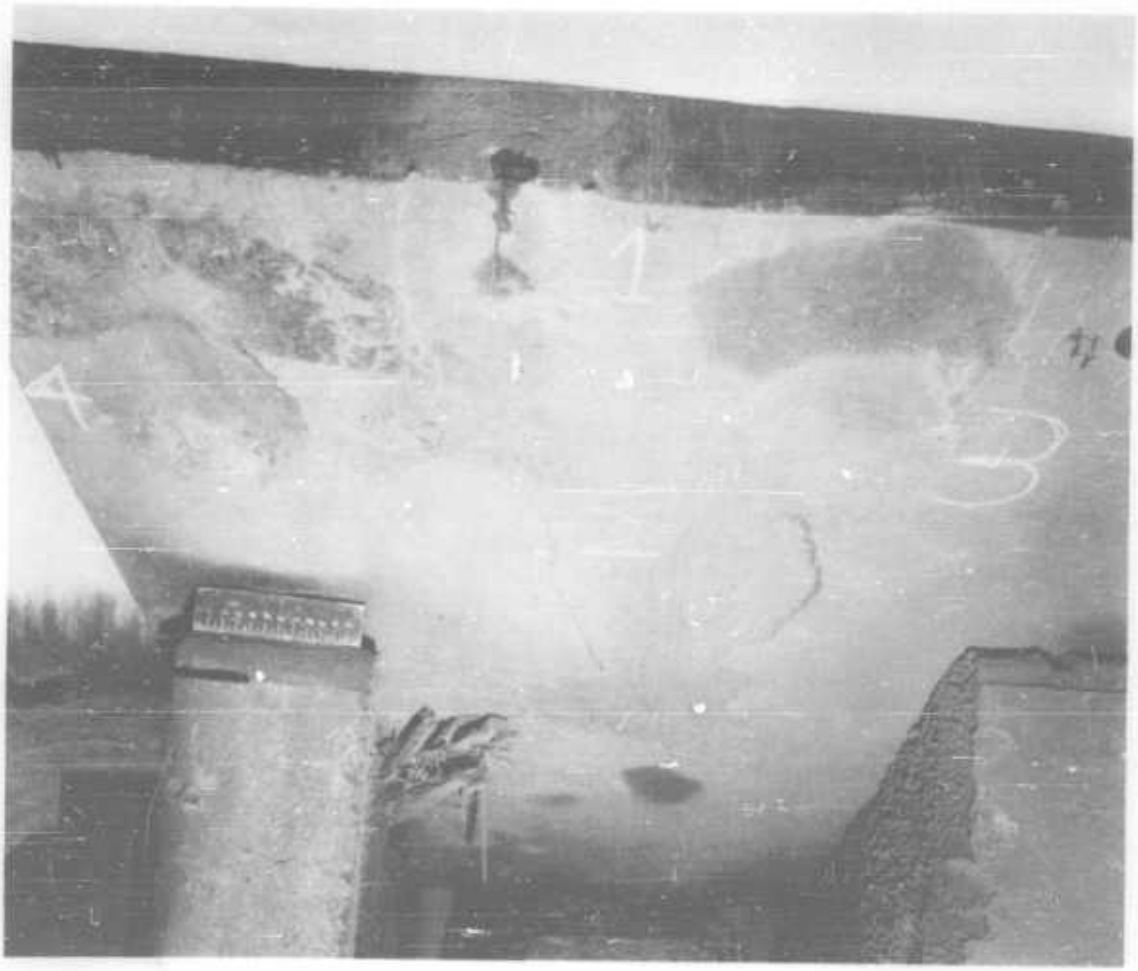
429Pn CONFIDENTIAL ABERDEEN PROVING GROUND 28 March 1957

Project No. TA1-5002H/TE20. Accuracy and Armor Defeating Evaluation of Shell, HEP, 155mm.

Open shutter photograph of Shell, HEP, 155mm, T152E5, striking 7 inch plate at 60 degrees obliquity.



B24568: Rear of 8 inch armor plate fired at 60 degrees obliquity, showing bulges. Bulges 1 and 2 were caused by T152E5 HEP Shell. Bulges 3 and 4 were caused by T152E6 HEP Shell. Distance from muzzle to plate center - 401.24 feet. Charpy value of plate - 62/81, Bhn 241.

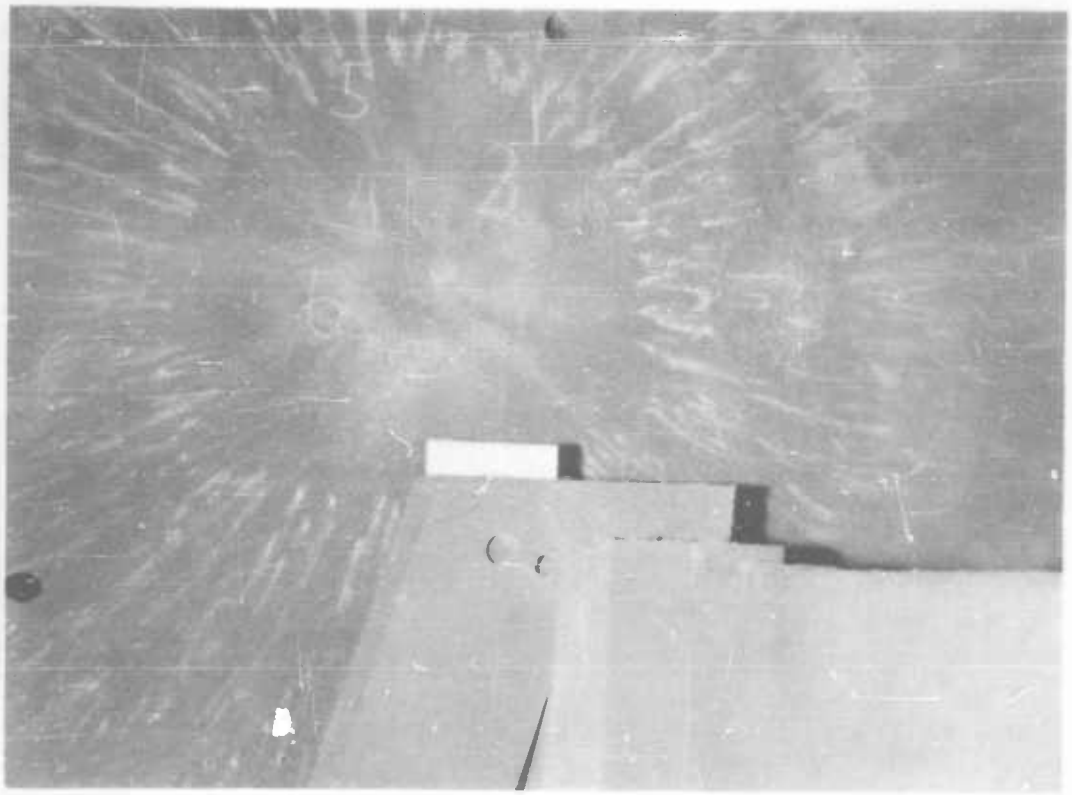


B24567: Face of 8 inch armor plate at 60 degrees obliquity. Note cracks on edge of plate adjacent to Round 1 which extend to face of plate.

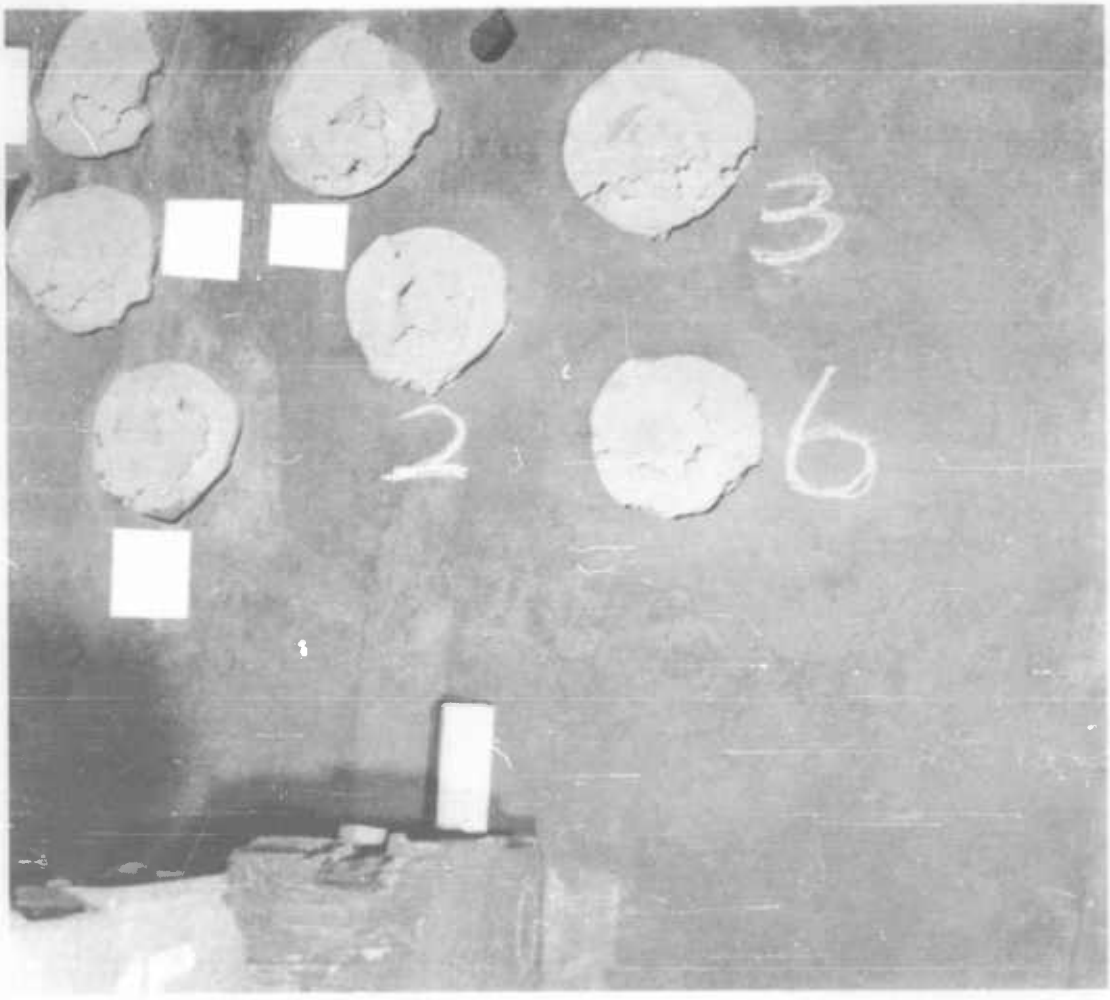
B24566: Photograph of Shell, HEP, 155mm, T152E5, with charge.

B24565: Photograph of Shell, HEP, 155mm, T152E6, with charge.

B24577: Side view of 8 inch plate at 0 degrees obliquity, showing depths of back spalls. Rounds 7 through 16. Note: back spall, Round 14, is a double spall.



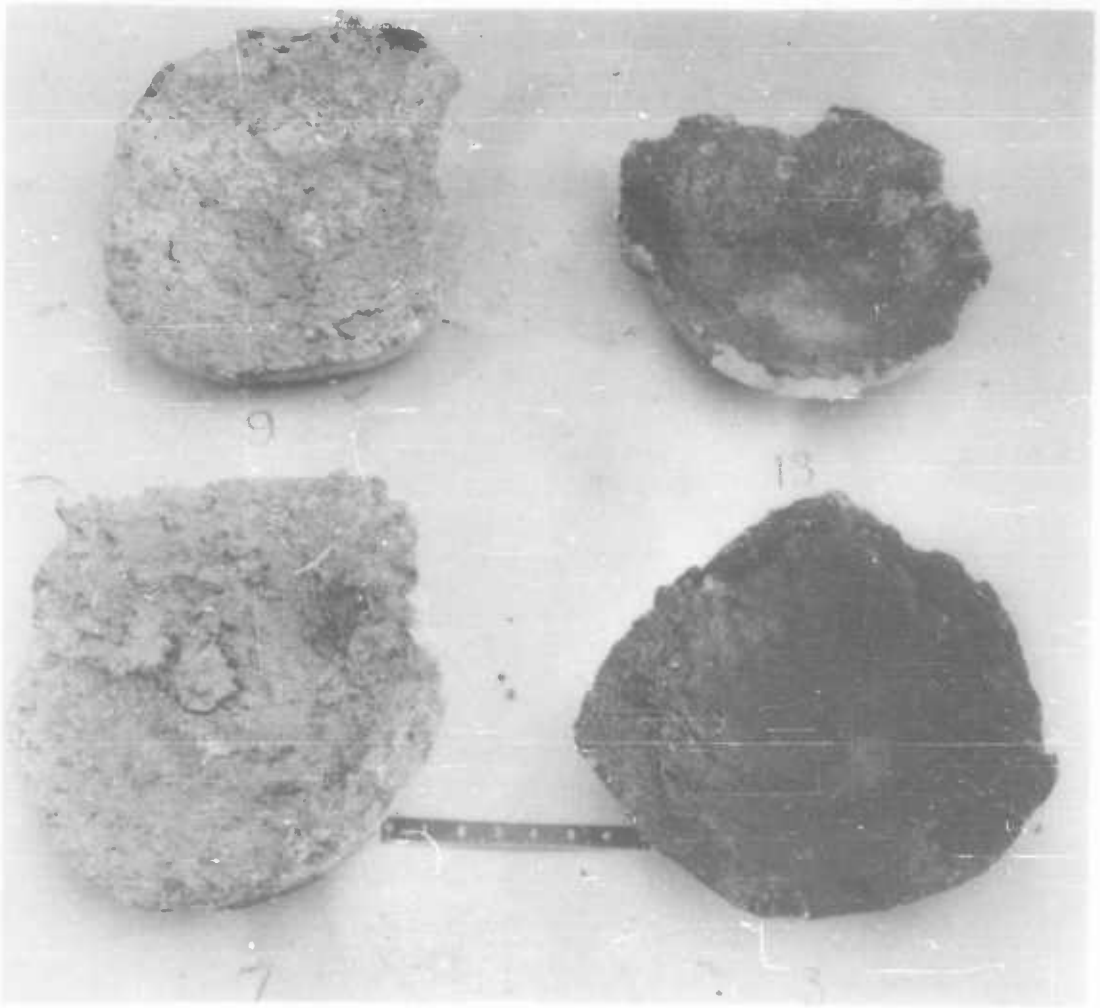
B24576: Front view of 8 inch plate fired at 0 degrees obliquity, showing hits. Rounds 1 through 6. Rounds 1, 3, and 4 failed to function and were low order due to bad fuzes.



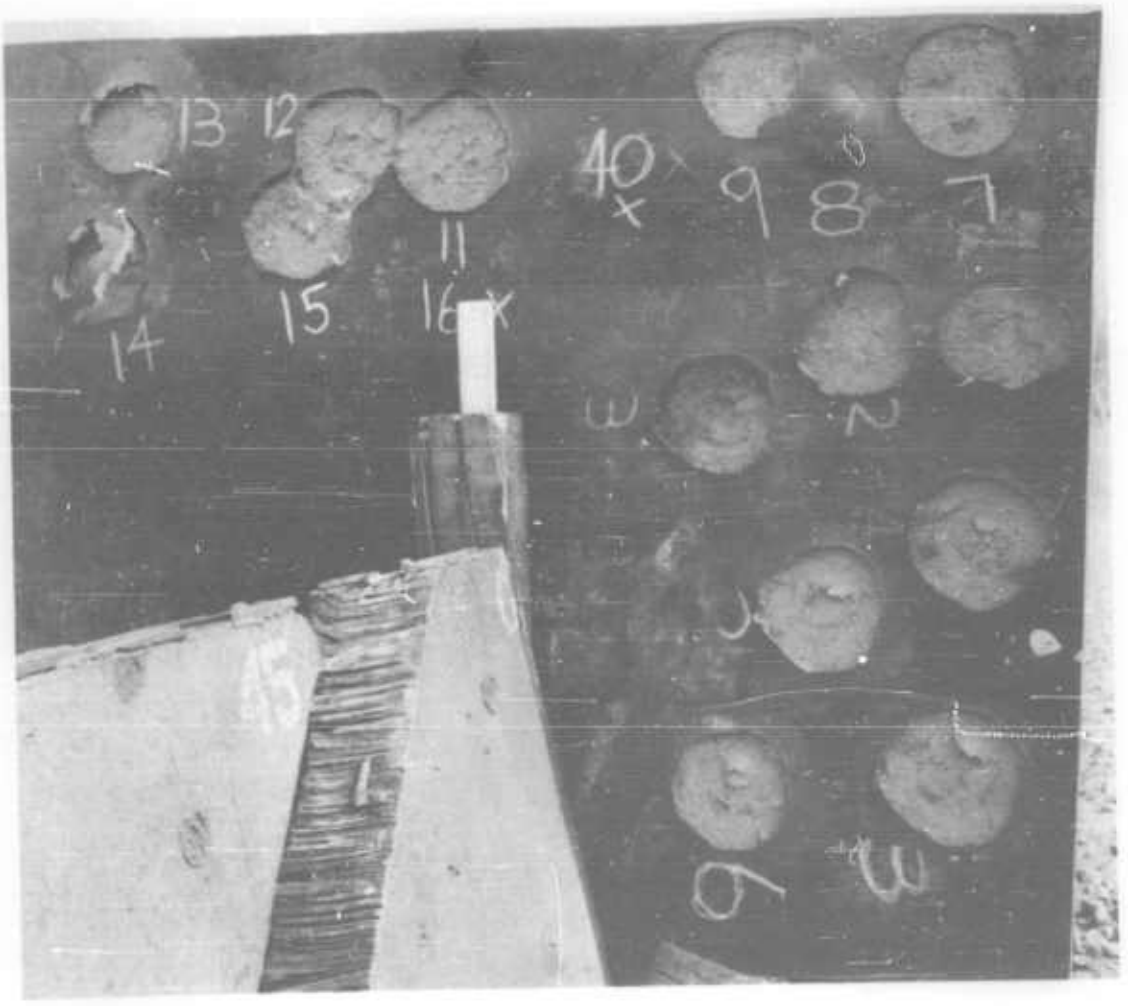
324575: Rear of 8 inch plate fired at 0 degrees obliquity, showing back spalls from Rounds 1 through 6. Rounds 1, 4, and 5 did not spall as fuze failed to function.

B24574: Front view of four back spalls. Weight of spalls - No. 3 - 48 lbs., No. 7 - 63 lbs., No. 9 - 38 lbs., No. 13 - 27 lbs. 8 inch plate fired at 0 degrees obliquity. Distance from muzzle to plate center - 401 feet.

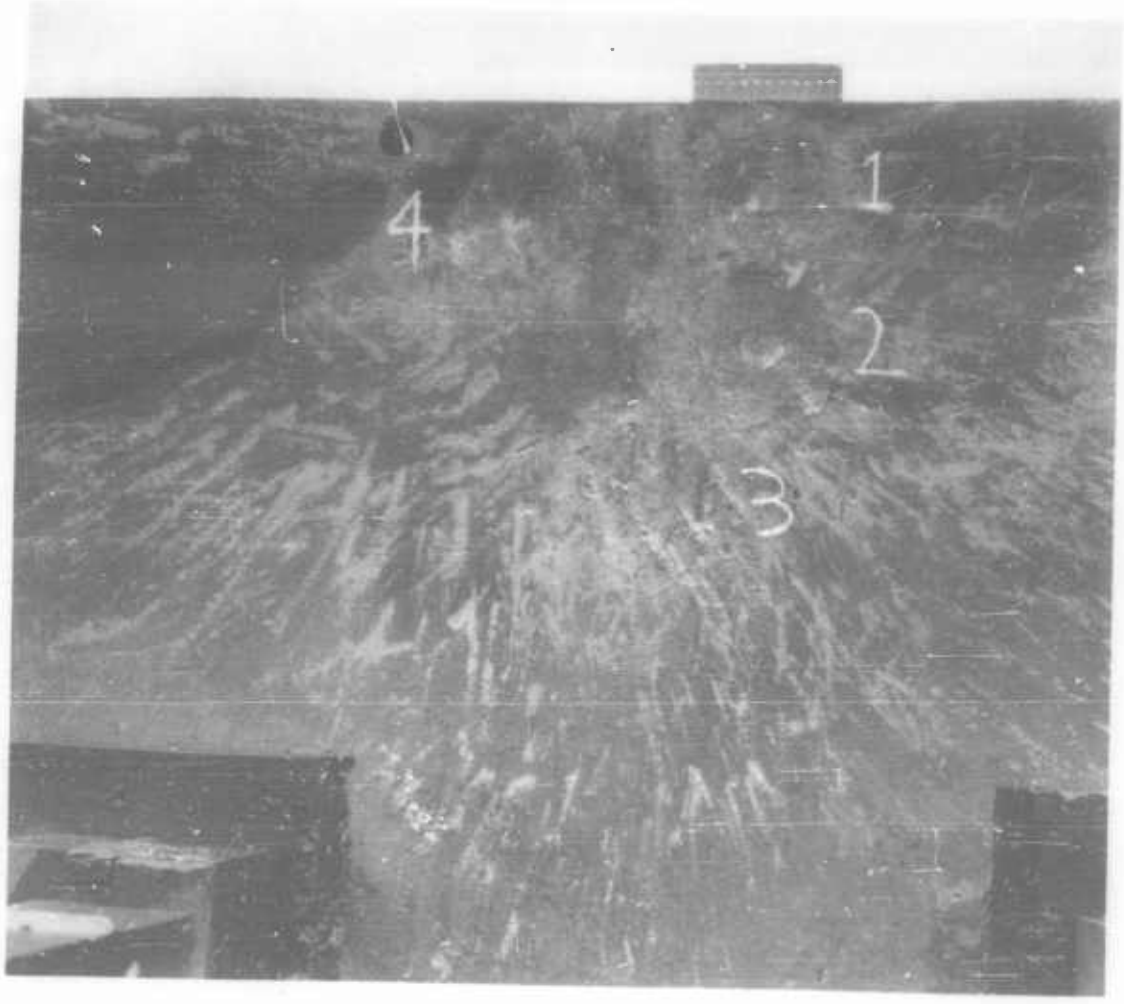
B24573: Front view of 8 inch plate fired at 0 degrees obliquity, showing hits. Rounds 7 through 16. The depth of impressions from the hits average 3/4 inch in depth.



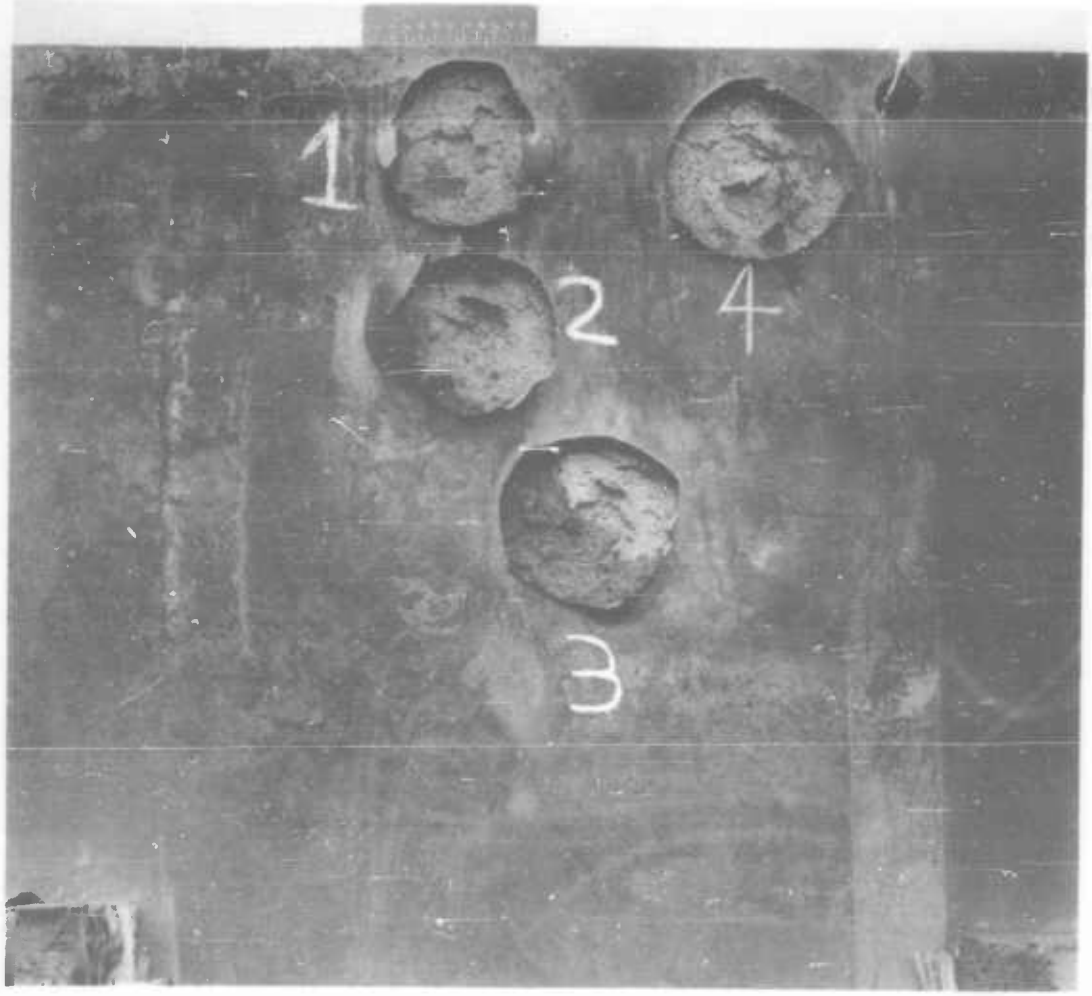
B24572: Rear view of four back spalls. Weight of spalls: No. 3 - 48 lbs., No. 7 - 63 lbs., No. 9 - 38 lbs., No. 13 - 27 lbs. 8 inch plate fired at 0 degrees obliquity. Distance from muzzle to plate center - 401 feet.



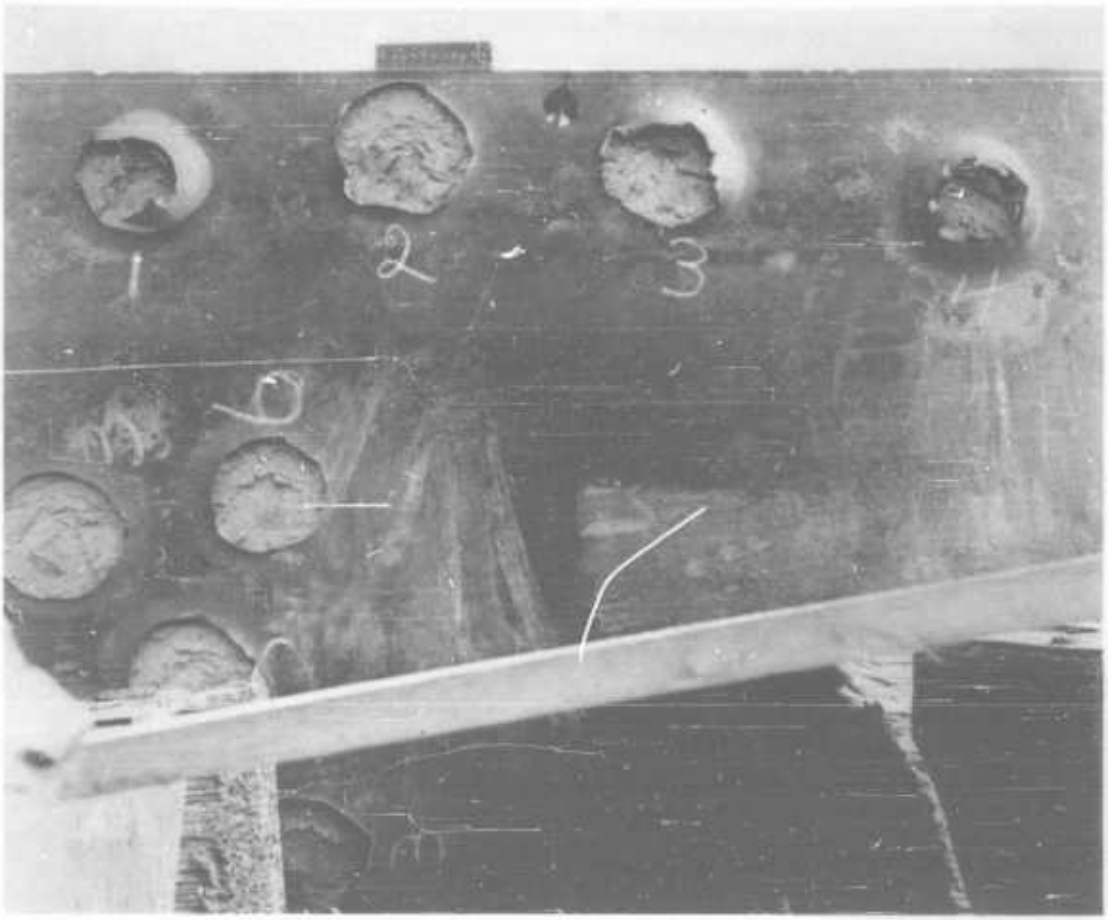
B24571: Rear of 8 inch armor plate fired at 0 degrees obliquity, showing back spalls from Rounds 7 through 16. Round 8 resulted in a bulge. Round 10 gave no spall due to fuze failure. Charpy value of plate - 71/71, Bhn 225/248. Distance from muzzle to plate center - 401 feet.



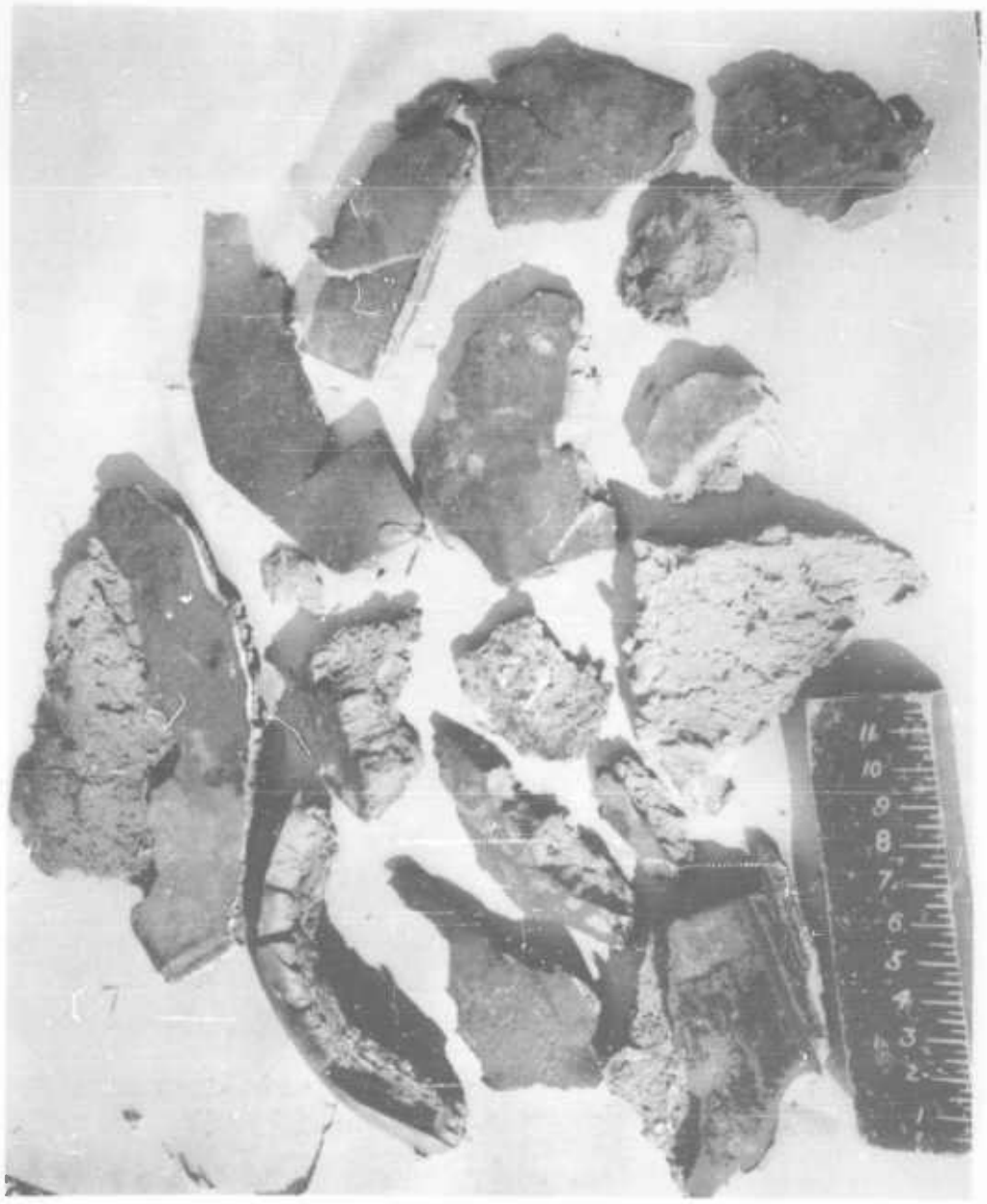
B24570: Face of 8 inch armor plate fired at 0 degrees obliquity, showing location of four hits.



B24569: Rear of 8 inch armor plate fired at 0 degrees obliquity, showing size of back spalls. Spalls 1 and 2 were caused by Shell T152E5. Spalls 3 and 4 by Shell T152E6. Charpy value of plate - 71/71, Bhn 225/248. Distance from muzzle to plate center - 401 feet.



B24587: Rear view of 8-inch plate fired at 0 degrees obliquity, showing back spalls of Rounds 1 - 4. Number 1 and 3, were hit by T152E5 Shell, Number 2 and 4, T152E6. Charpy value of plate 71/71, BHN 225/248. Distance, muzzle to plate center - 401 feet.

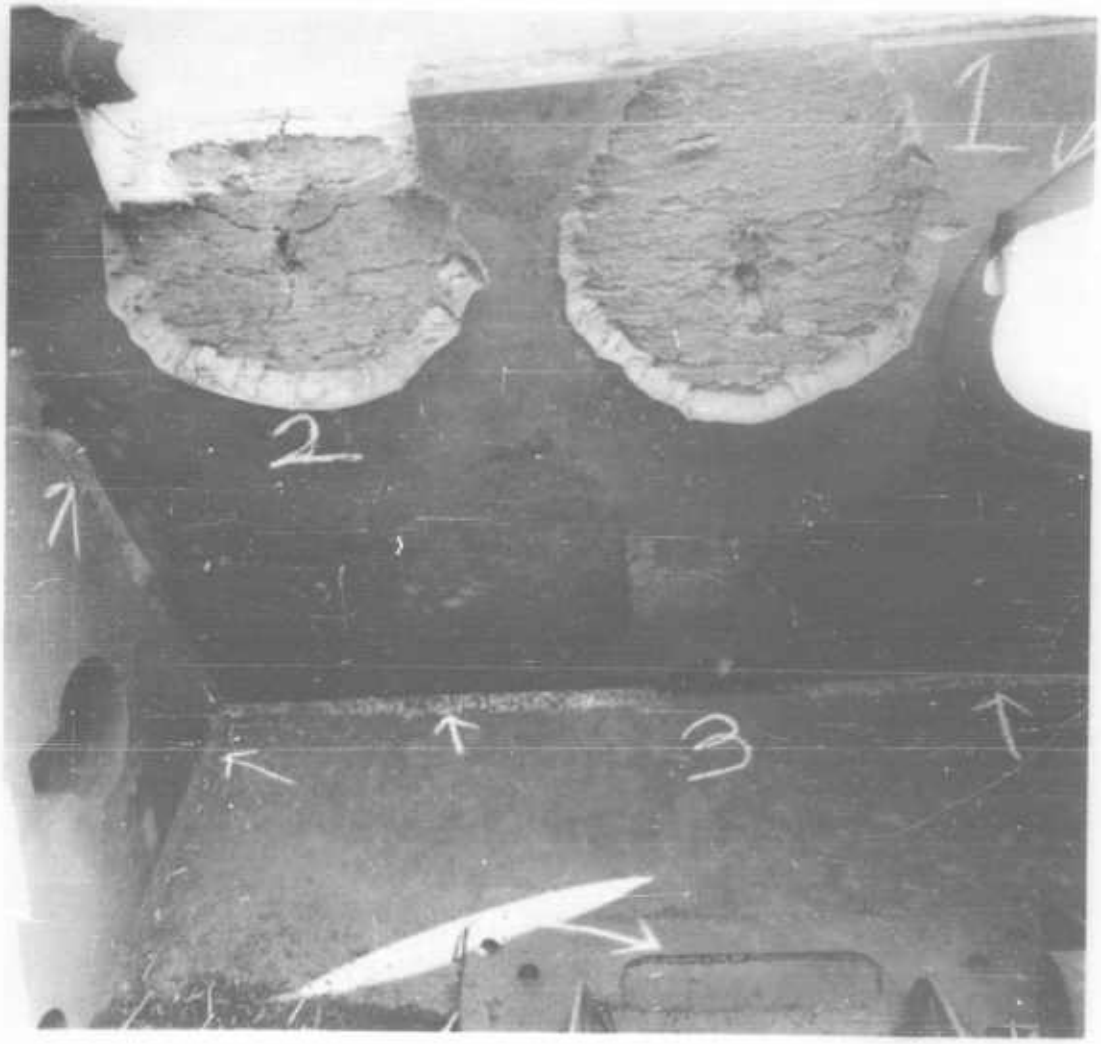


B24586: Photograph of back spall pieces from Round 15 on King Tiger Hull (German). Weight of pieces - 87 lbs.

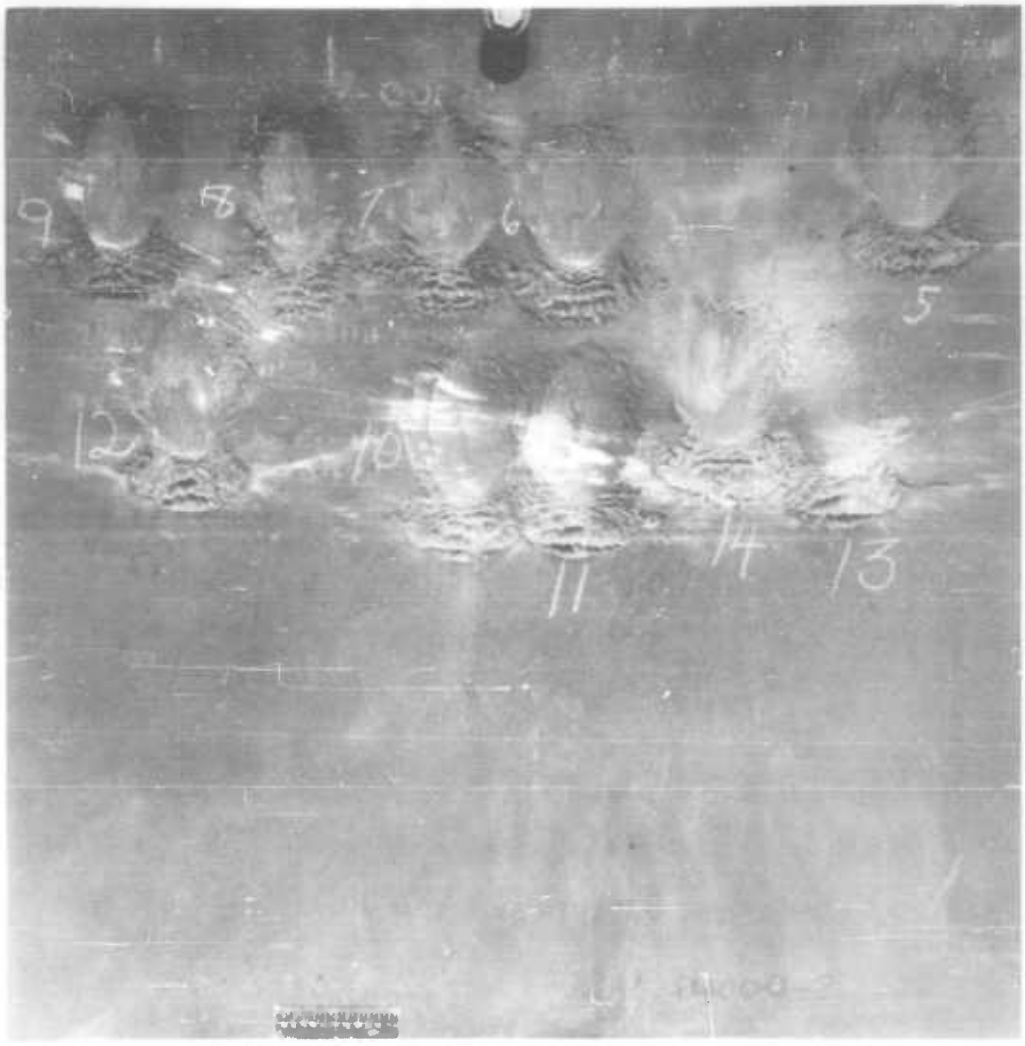
B24585: View of hits on King Tiger Hull (German) frontal armor plate. Plate 6 inches thick, 44 degrees obliquity. Arrows indicate broken welds. Distance, muzzle to center of plate - 402 feet.

B24584: Three-quarter right front view of King Tiger Hull (German), showing depths of hits. Arrows point to broken welds. Right frontal side suffered similar weld breaks.

B24583: Interior of King Tiger Hull (German), showing damage caused by back spalls. Three frontal hits.



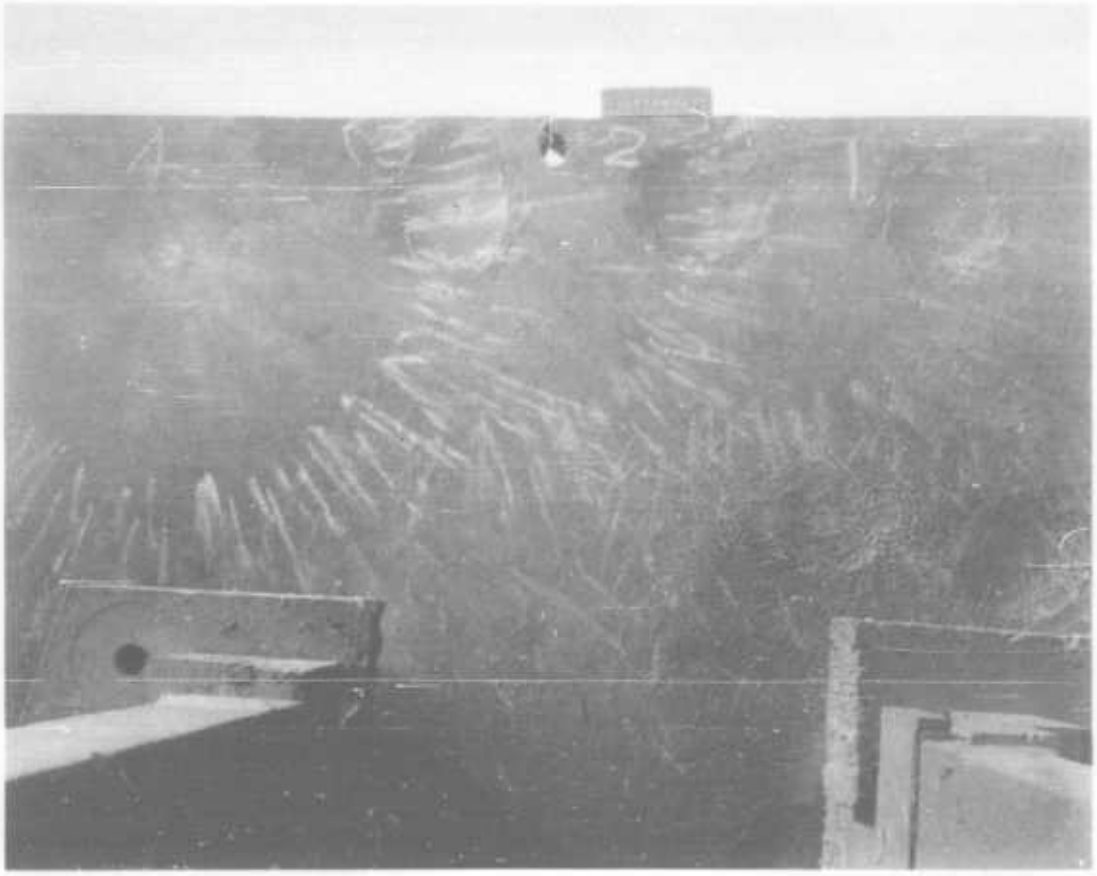
B24582: Rear view of 6-inch frontal plate, showing three hits from 155mm HEP Shell. Hit No. 3 was at junction of two 6-inch plates. Arrows point to broken welds and cracks.



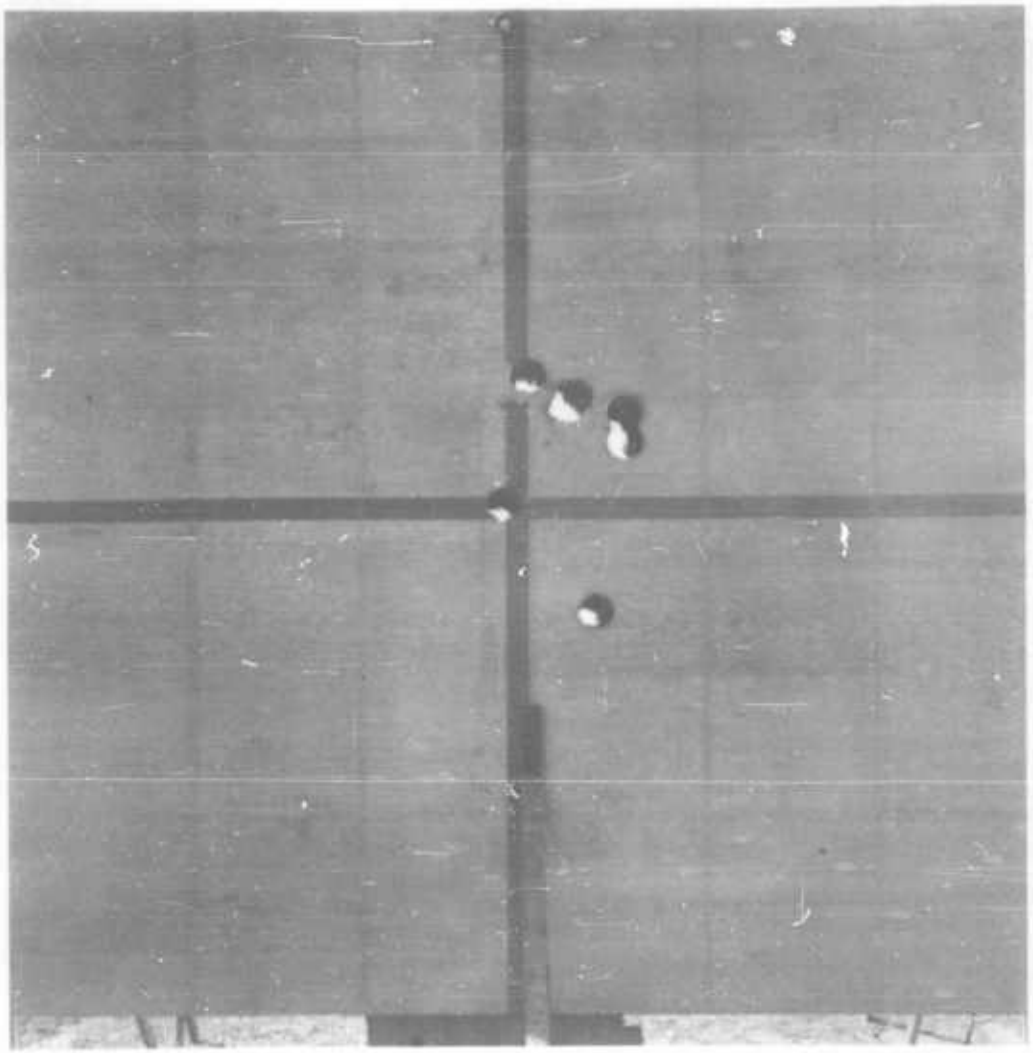
B24581: Front view of 7-inch plate fired at 60 degrees obliquity, showing imprints of hits. Rounds 5 and 6 were fired muzzle to plate center 241 feet. Rounds 7 - 14, muzzle to plate center - 400 feet.

B24580: Rear view of 7-inch plate fired at 60 degrees obliquity, showing back spalls from Rounds 5 - 14. Rounds 5, 7, 9, 11, and 13 were T152E5. Rounds 6, 8, 10, 12, and 14 were T152E6. Charpy value of plate - 57/34, BHN 229.

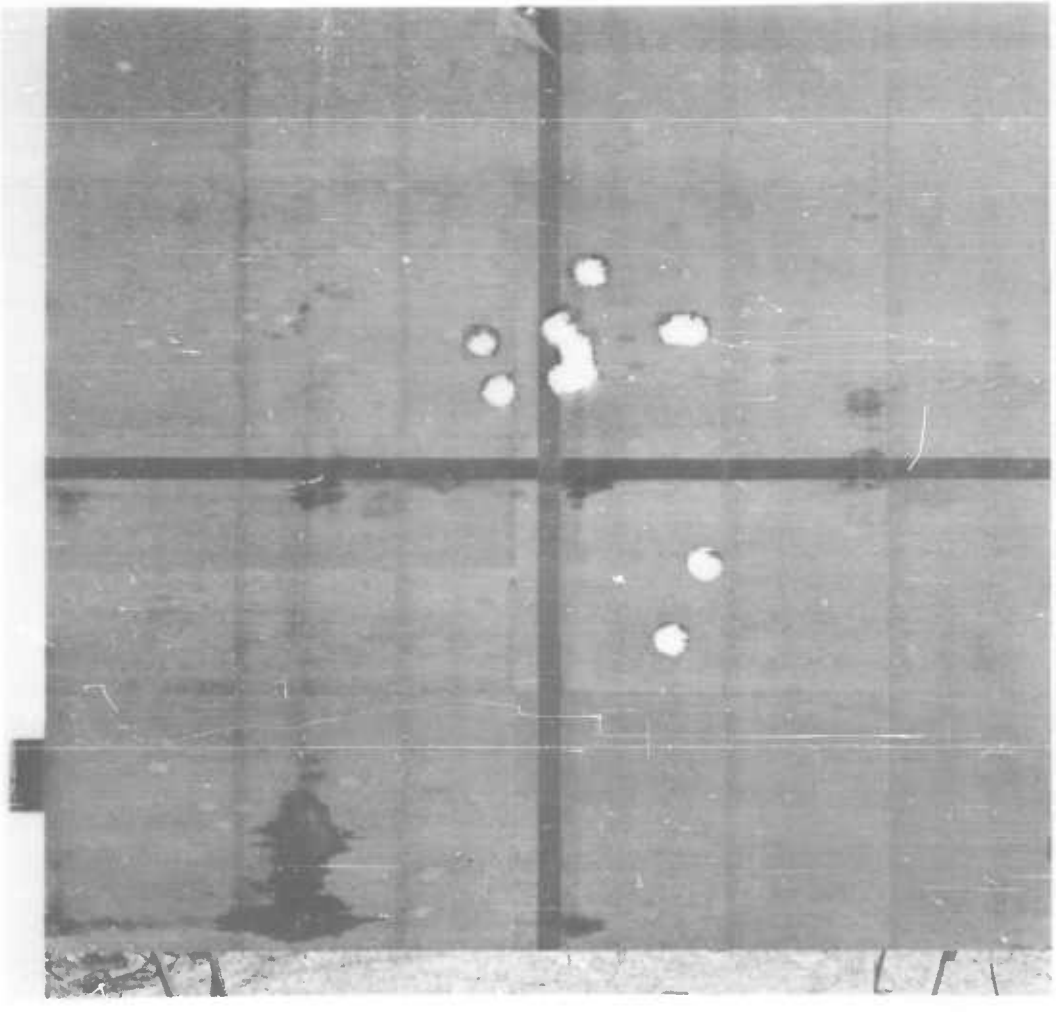
B24579: View of back spalls from 7-inch plate fired at 60 degrees obliquity. Distance, muzzle to center of plate - 400 feet. Average weight of spalls - 51 lbs.



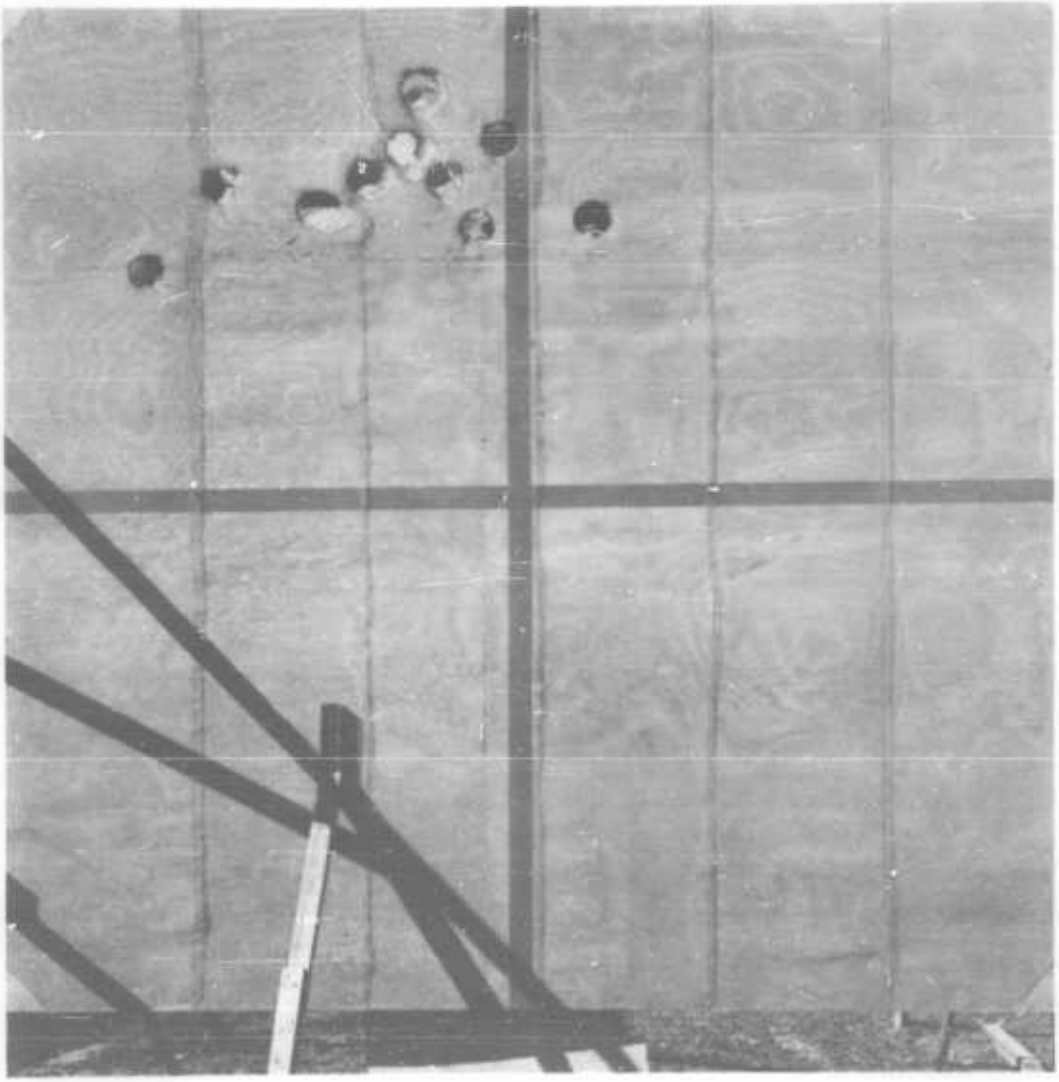
B24578: Front view of 8-inch plate fired at 0 degrees obliquity, showing four hits on plate. Depth of hits average 1 1/4 inches.



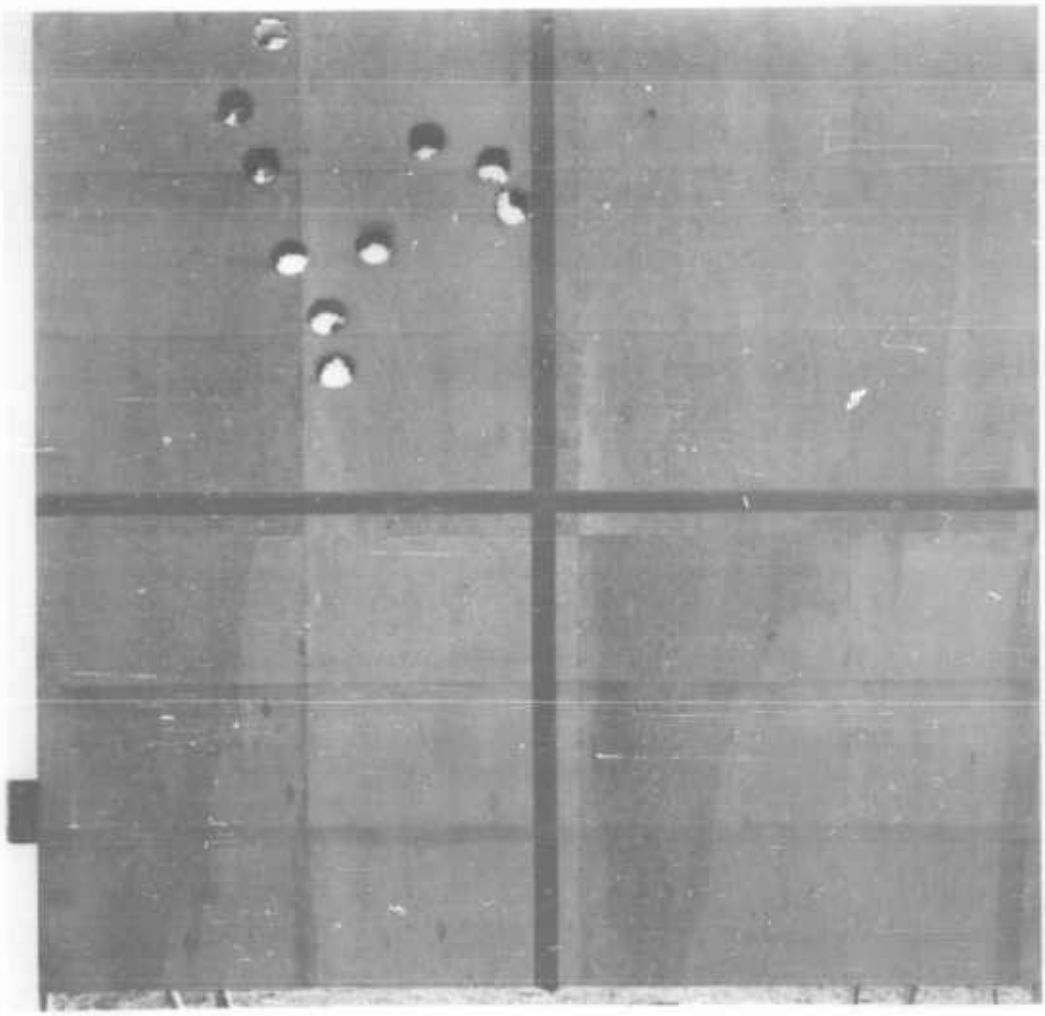
B22001: Hits on 1000 yard accuracy target with T152E5 HEP Shell. Vertical PE .31 mils reduces to .09 omitting round in lower right hand quadrant. Lateral PE .11.



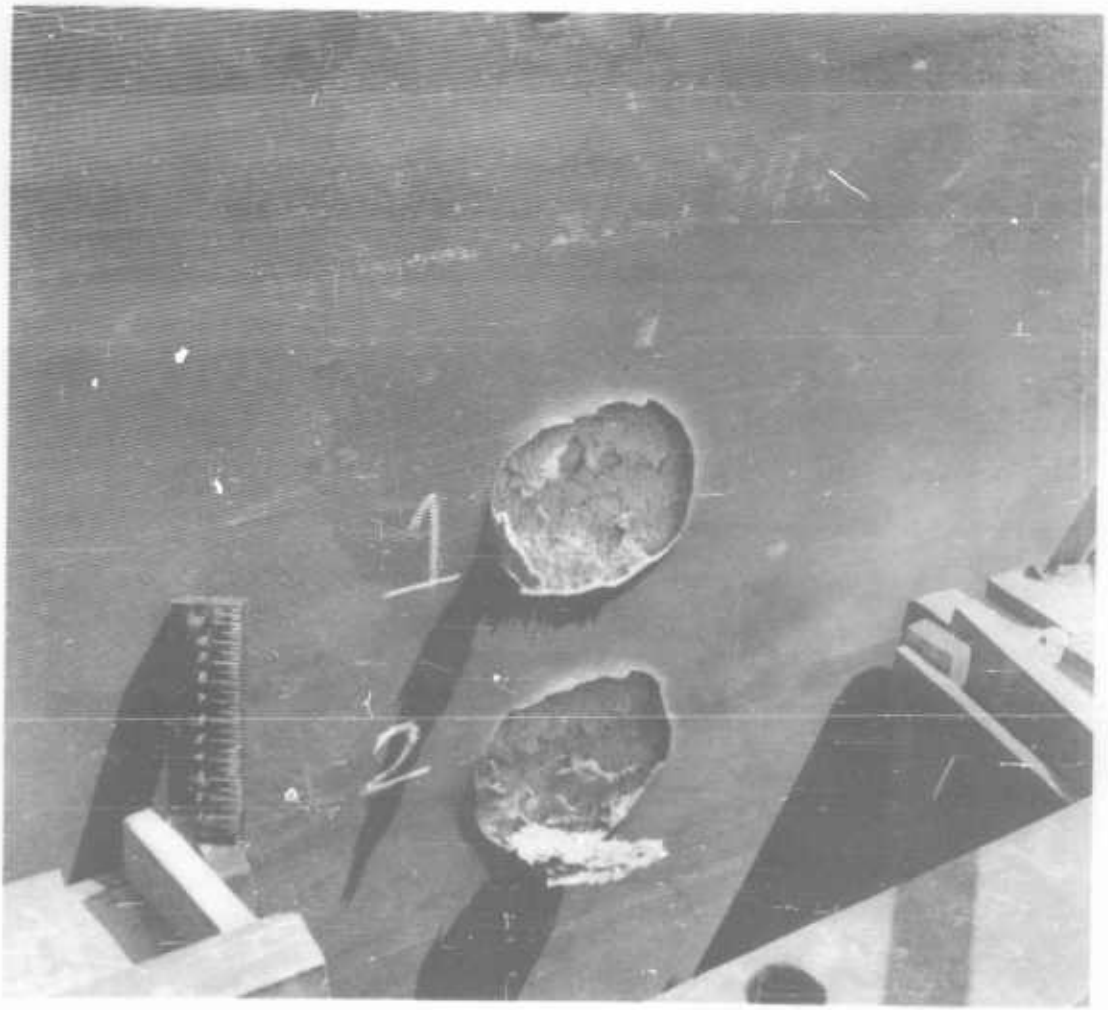
B22002: Hits on 1000 yard accuracy target with T152E5 HEP Shell. Vertical P.E. .39 reduces to .13 omitting two rounds in lower right hand quadrant. Lateral P.E. .27 mils.



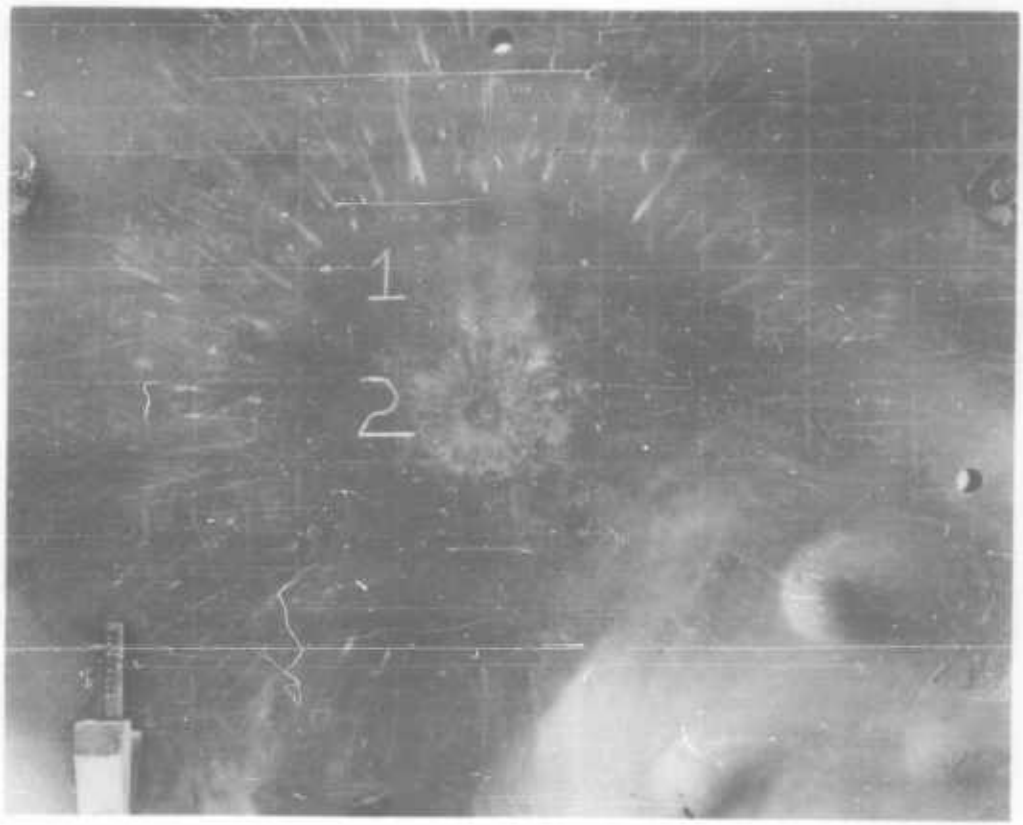
B22003: Hits on 1000 yard accuracy target with T152E6 HEP Shell. Vertical P.E. .14 mils. Lateral P.E. .34 mils.



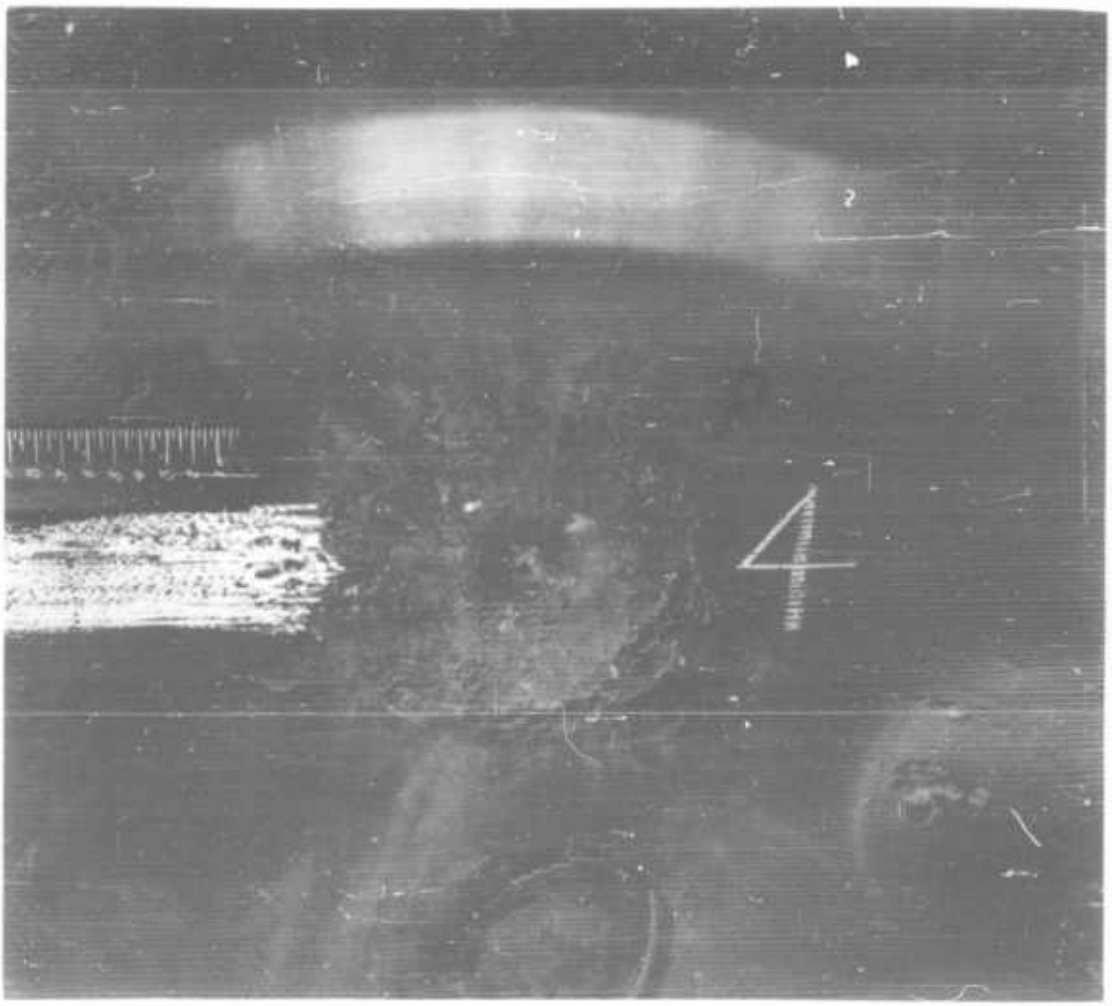
B22004: Hits on 1000 yard accuracy target, with T152E5 HEP Shell. Vertical P.E. .34 mils. Lateral P.E. .32 mils.



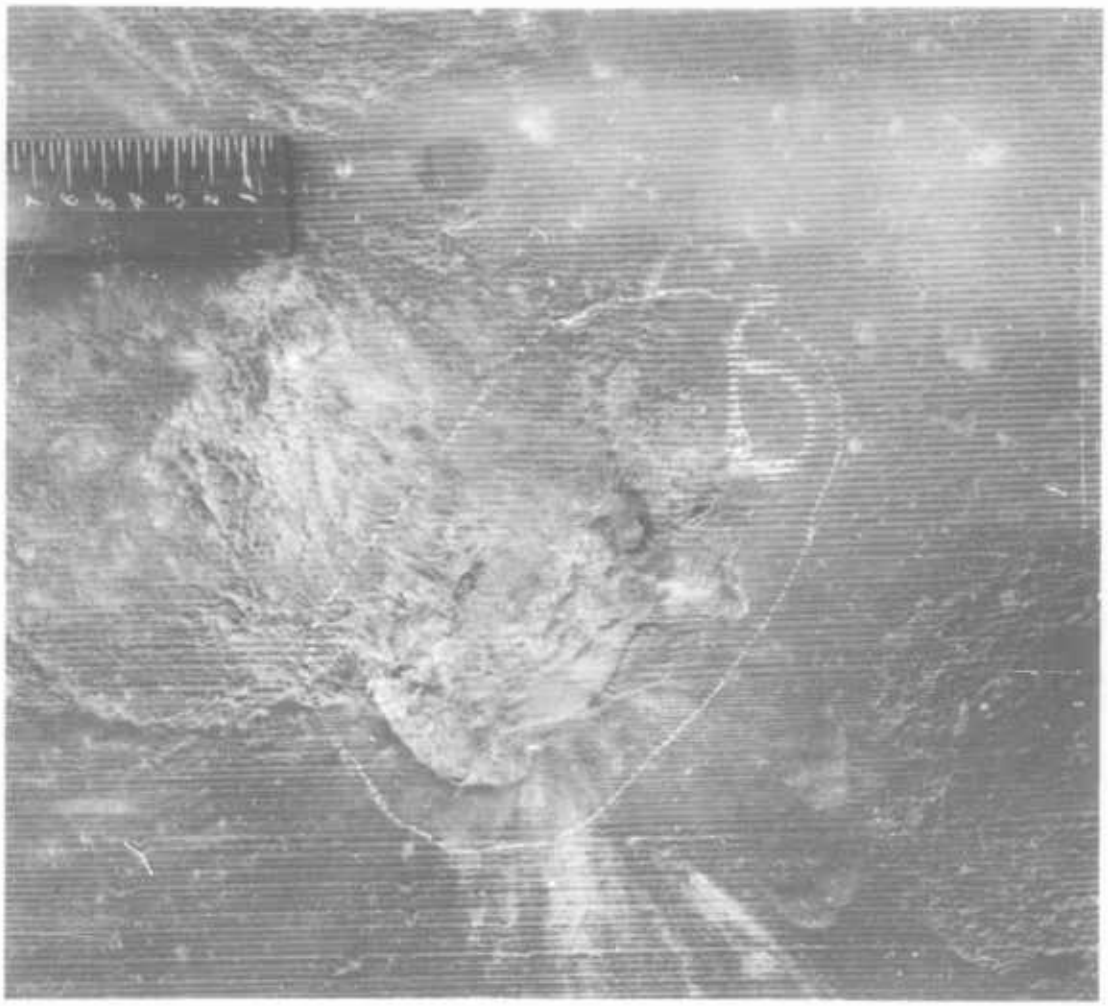
B22005: Rear view of 8-inch plate fired at 1000 yards, zero degrees obliquity, showing back spalls from Rounds 1 and 2. Round 1, T152E6; Round 2, T152E5. Charpy value of plate - 62, BHN 241. Depth of spalls average 2 1/4 inches.



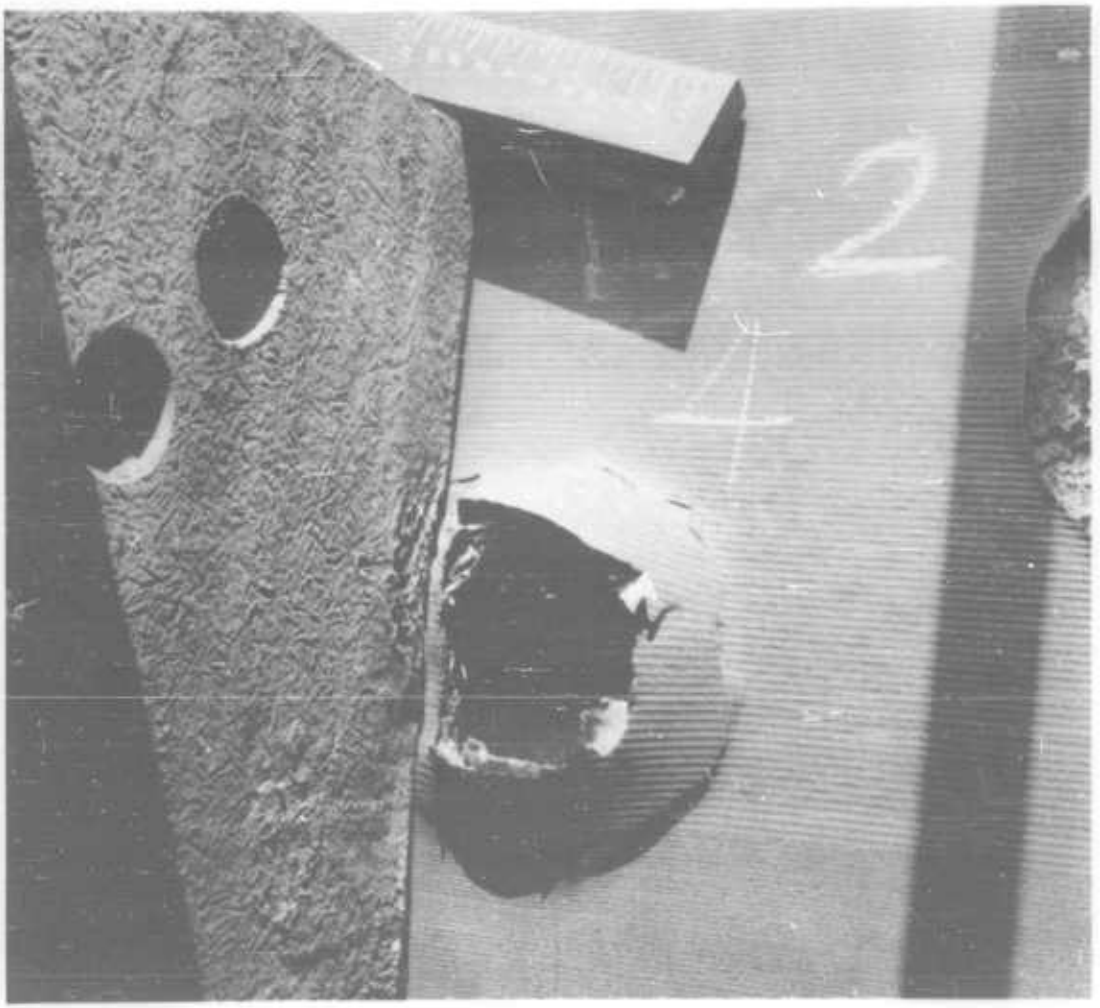
B22006: Front view of 8-inch plate fired at 1000 yards, zero degrees obliquity showing first hits on plate. Depth of hits average 1 1/8 inches.



B22007: Front view of 8-inch plate fired at 1000 yards, zero degrees obliquity showing Round 4. Depth of hit - one inch.



B22008: Front view of 8-inch plate fired at 1000 yards, zero degrees obliquity showing hit. This round was of low order due to fuze failure (T152E6).

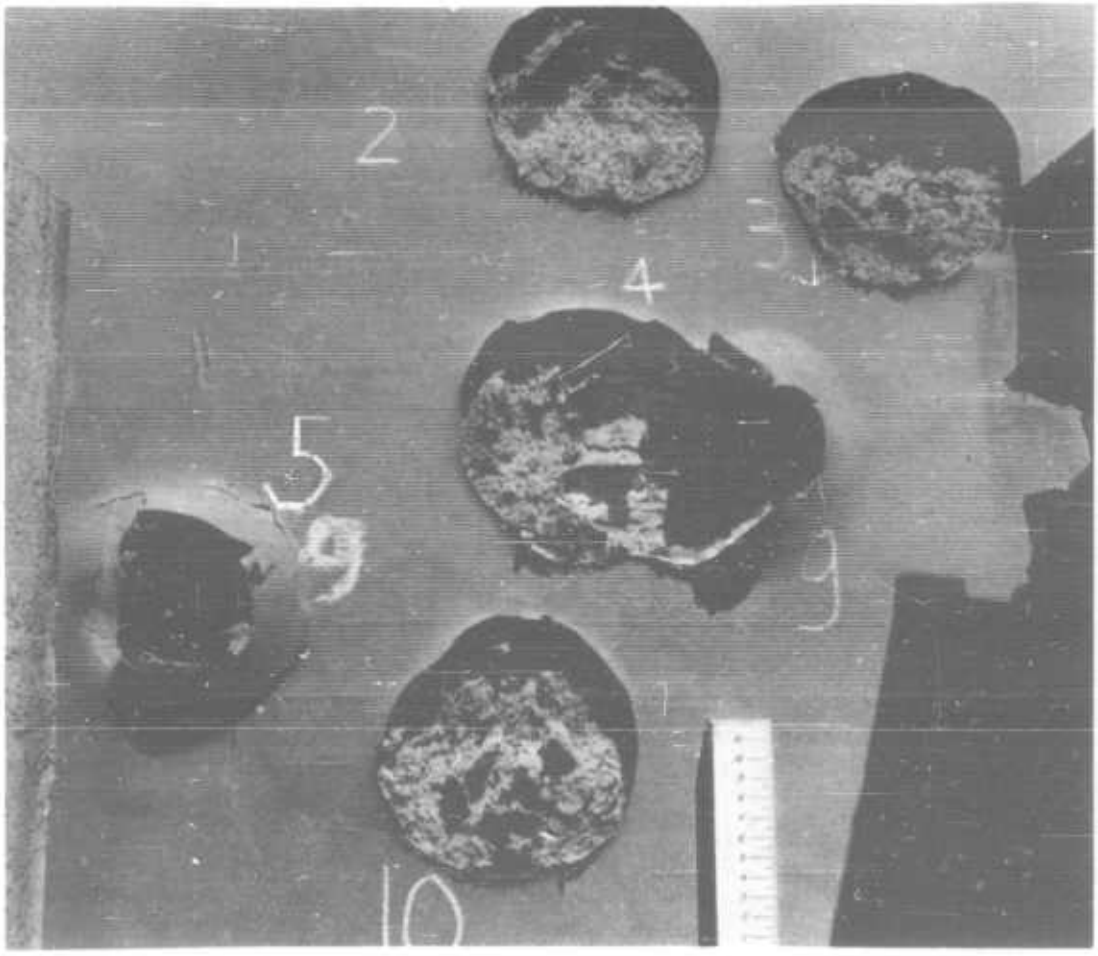


B22009: Rear view of 8-inch plate fired at 1000 yards, zero degrees obliquity, showing back spall from Round 4. T152E6. Depth of spall - 2 inches. Charpy value of plate - 62, BHN 241.

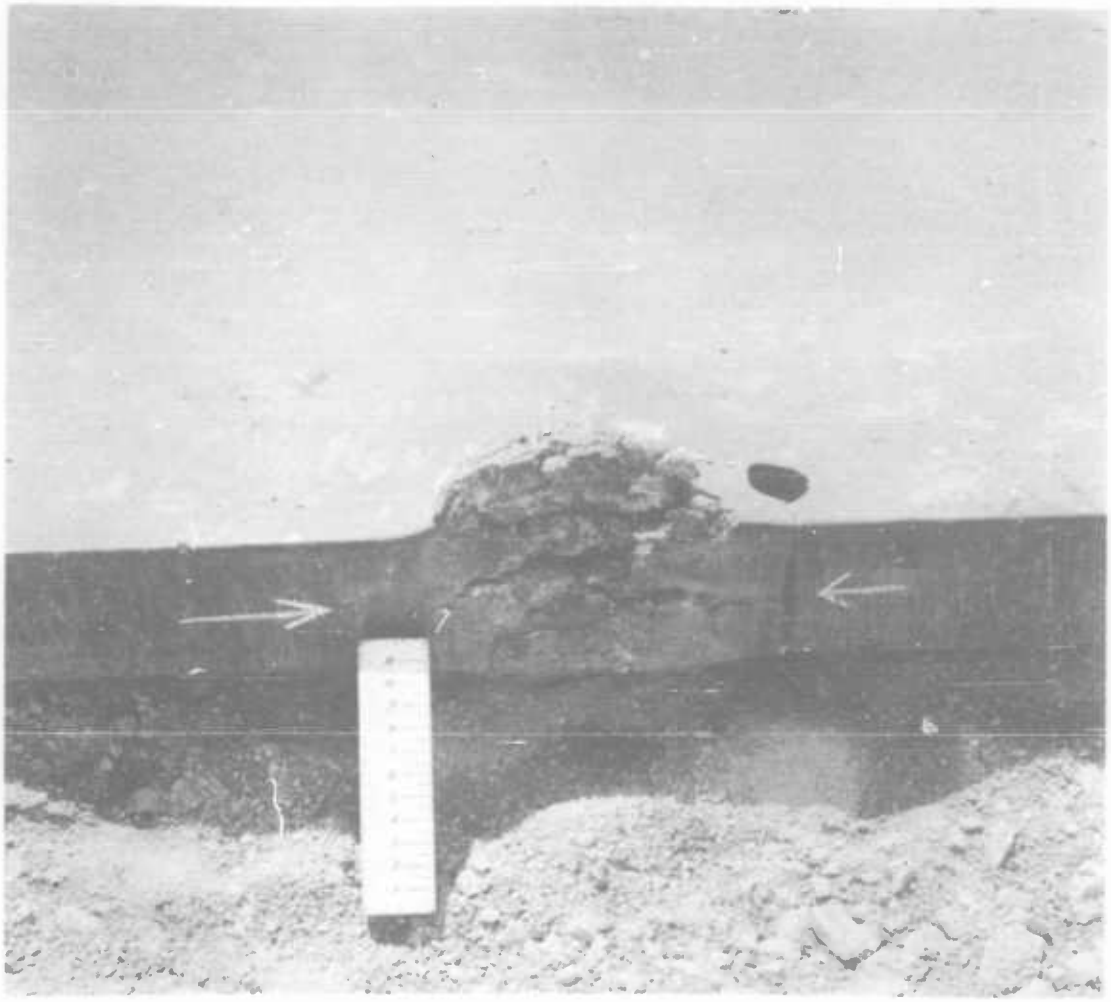
B22045: Front view of plate showing hits on 7-inch plate at 1000 yards with plate set at 0 degrees obliquity and splatter plate. The hole that is directly in front of the splatter plate was caused by Round 7 which fell short. The hit that bulged the splatter plate was caused by Round 8.

B22046: Rear view of 8-inch plate fired at 1000 yards at 0 degree obliquity showing back spalls of Round 11, T152E5 and Round 12, T152E6. The depth of the back spalls averaged 1-7/8 inches. Charpy value of the plate was 62, BHN 241.

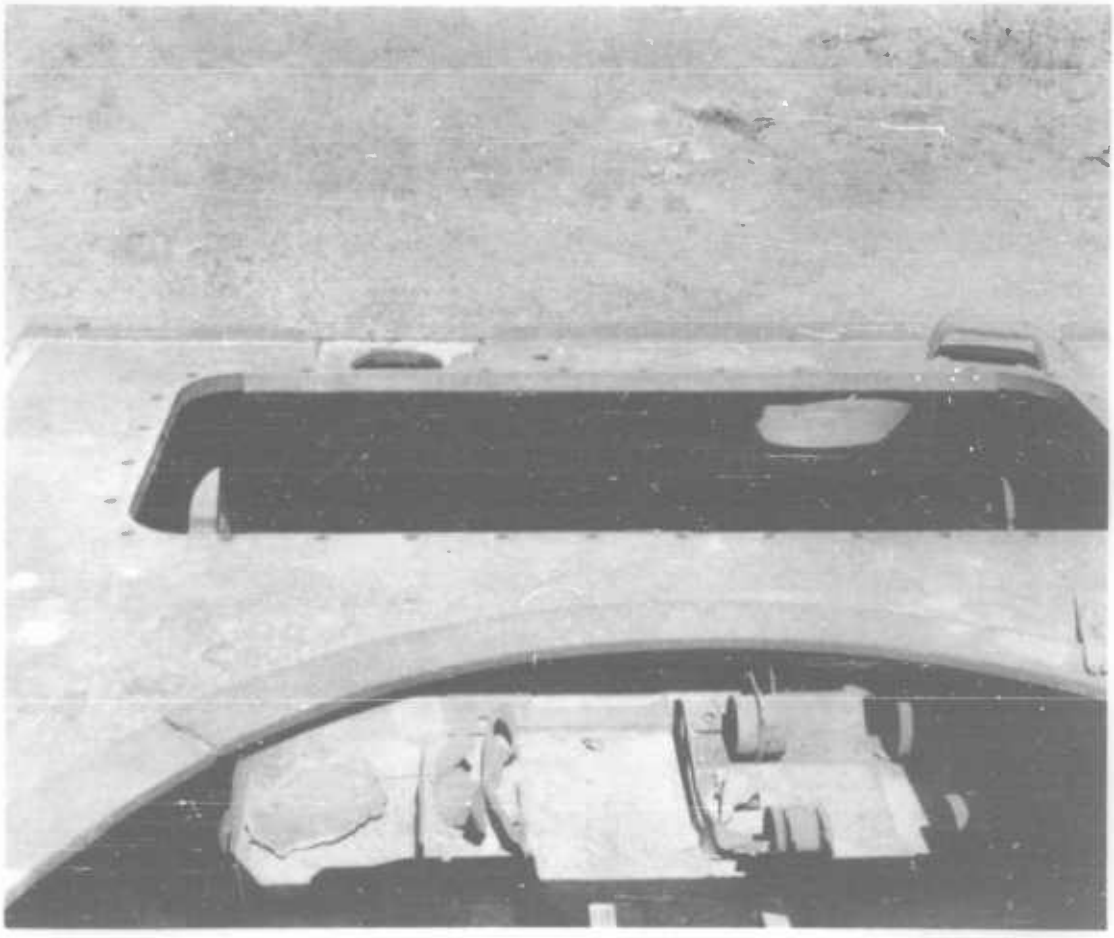
B22047: Front view of 8-inch plate fired at 1000 yards at 0 degrees obliquity showing hits on plate Rounds 1, 6, 7 and 8 missed the plate. Rounds 3, 5, 9 and 11, T152E5 and Rounds 2, 4, 10 and 12, T152E6.



B22048: Rear view of 8-inch plate fired at 1000 yards at 0 degree obliquity showing back spalls from Rounds 2, 3, 4, 5, 9 and 10. Rounds 3, 5, and 9 were T152E5; Rounds 2, 4 and 10 were T152E6. Charpy value of the plate was 62, BHN 241.



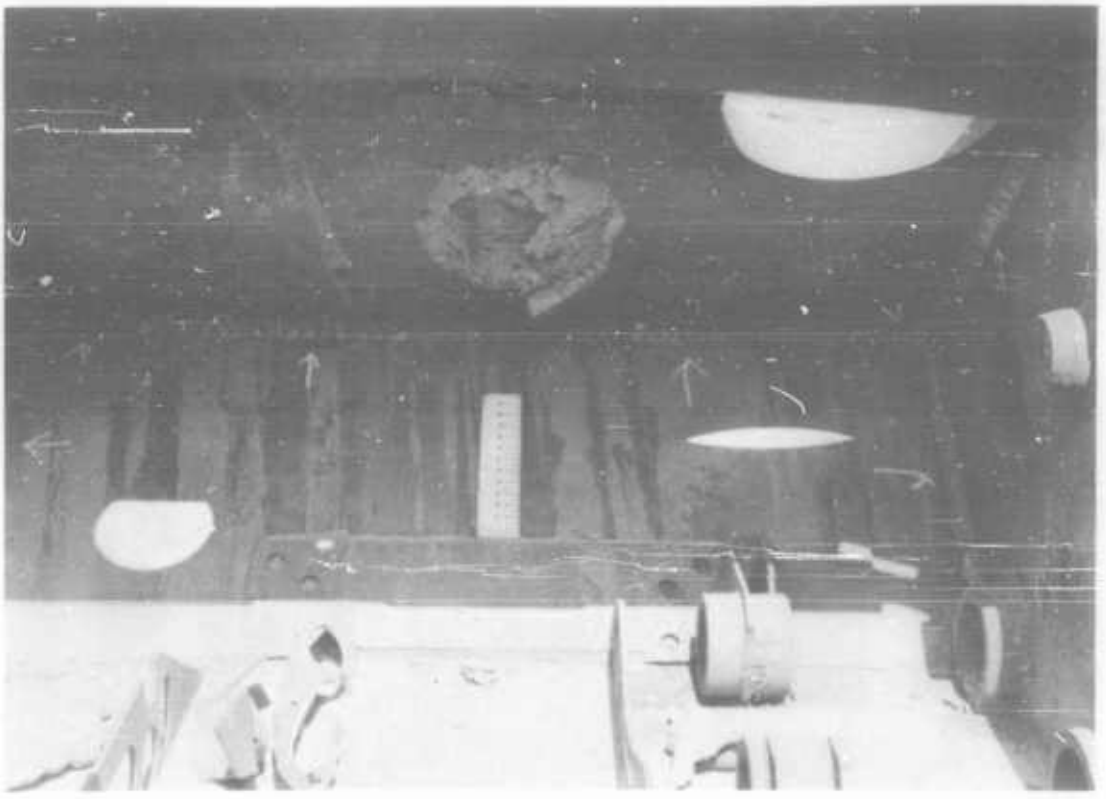
B22049: Hit on 5-inch splatter plate showing laminations. The petaling effect occurred on both sides of the plate. The depth of the cracks extend 7 inches in the center of the arrows. This was Round 8, T152E6.



B24635: Interior of King Tiger Hull (German) fired at 1300 yards showing spall and back spall damage. Arrows indicate broken welds. Depth of back spall 2 inches.

B24636: Front view of King Tiger Hull (German) fired at 1300 yards showing hit on frontal plate which was 44 degrees obliquity. Round 13, T152E5. Arrows indicate broken welds. Depth of hit was 1 1/4 inches.

B24637: Side frontal view of King Tiger Hull (German) fired at 1300 yards showing extent of damage and depth of hit. Arrows indicate broken welds.



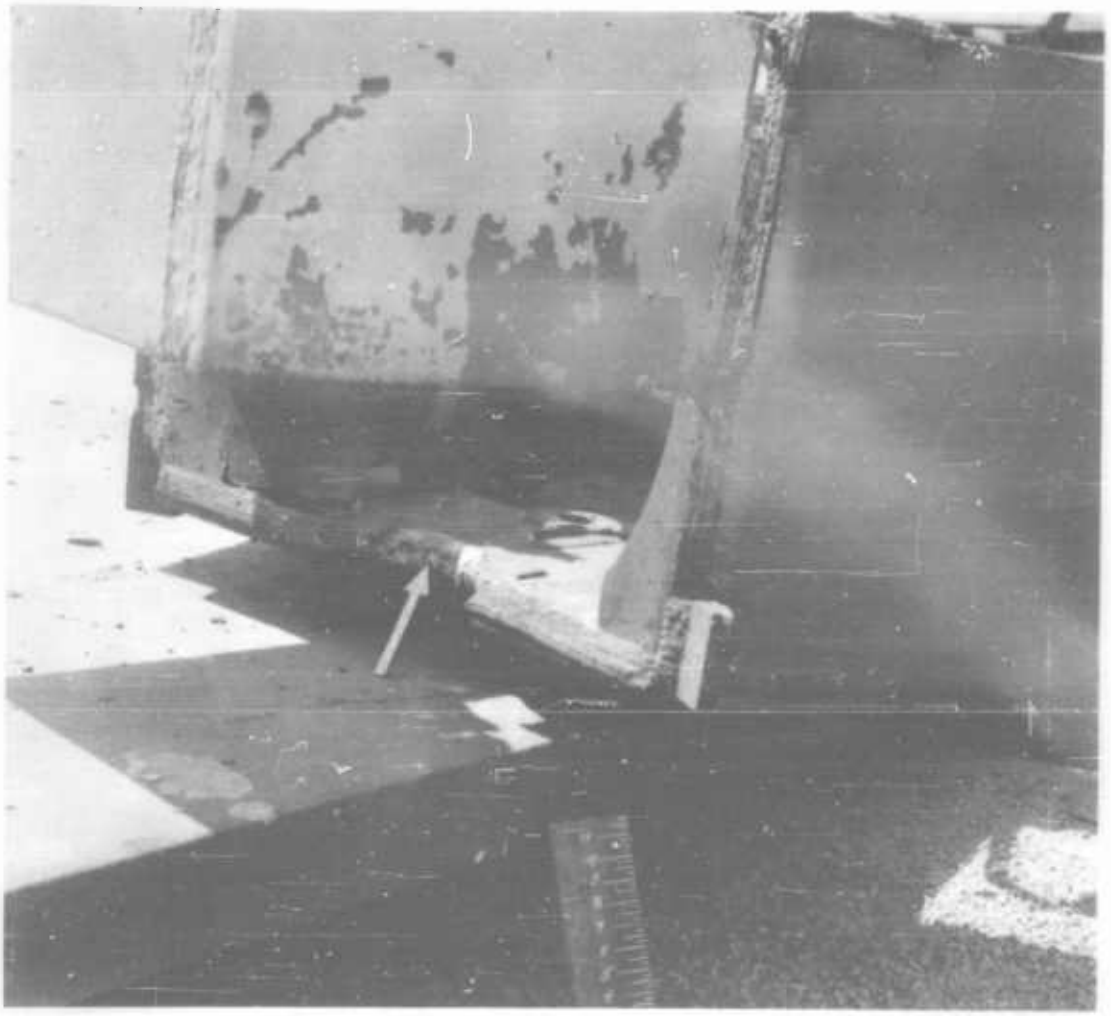
B24638: View of back spall of King Tiger Hull (German) fired at 1300 yards showing back spall. Depth of back spall, 2 inches.

B24755: Front view of 7-inch plate fired at 1000 yards at 60 obliquity, showing hits on plate. The top of the plate was supported by a M36, Gun Motor Carriage.

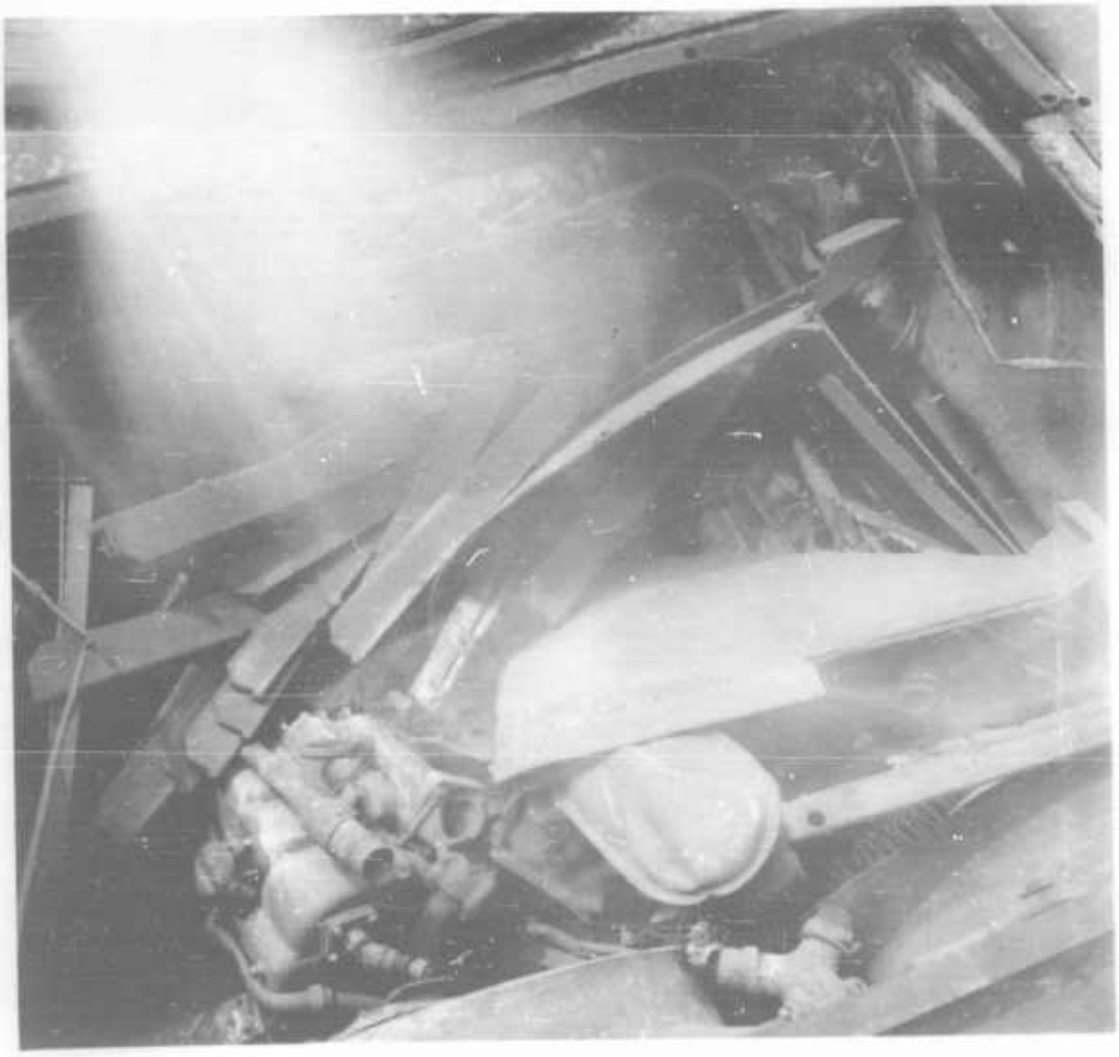
B24756: Photograph of M36, Gun Motor Carriage, showing position of turret after hit by Shell, HEP, 155mm, T152E6, at base of turret ring. The top plates of the turret have been blown off. Range fired at: 1000 yards.

B24757: Side view of M36, Gun Motor Carriage, showing damage caused by hit of Shell, HEP, 155mm, T152E6, at base of turret. Range fired at: 1000 yards.

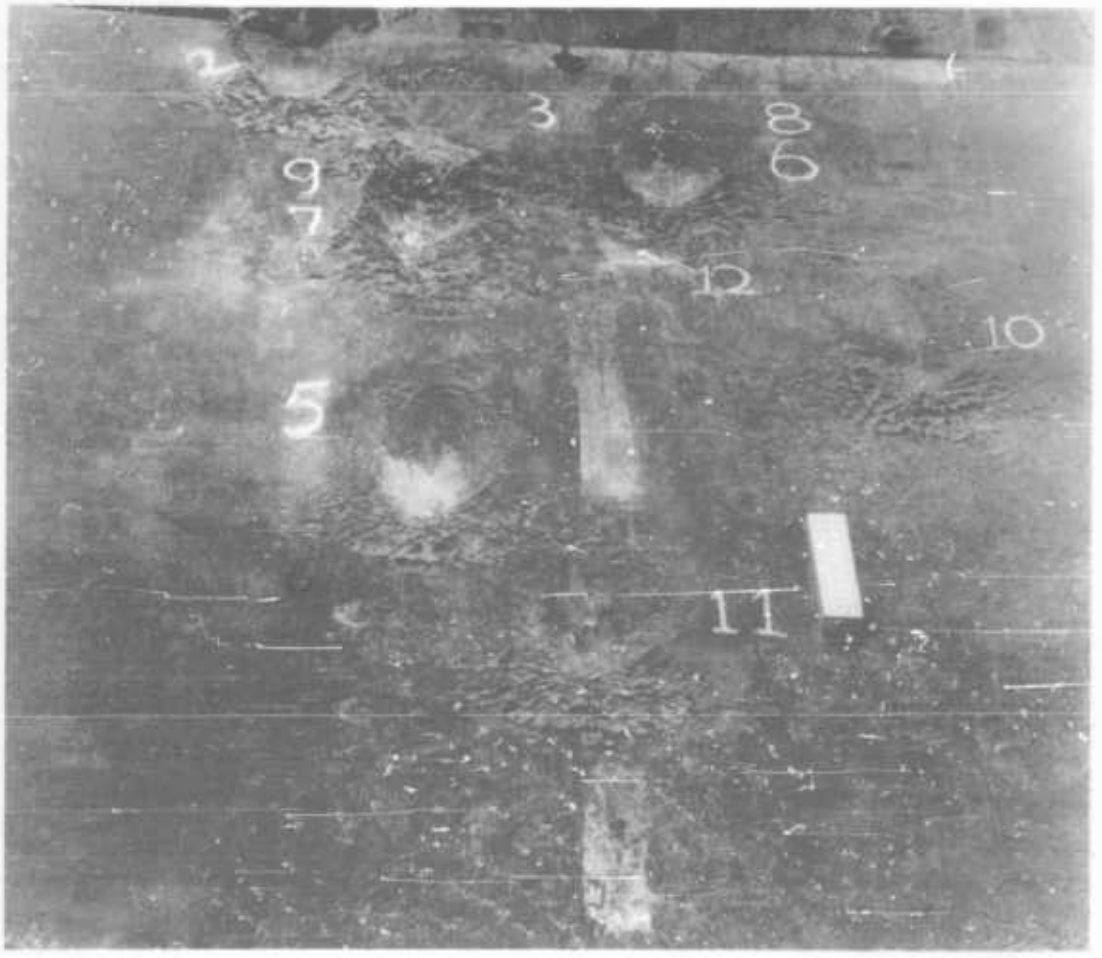
B24758: Interior view of turret, M36, Gun Motor Carriage, showing damage caused by one hit of Shell, HEP, 155mm, T15E6.



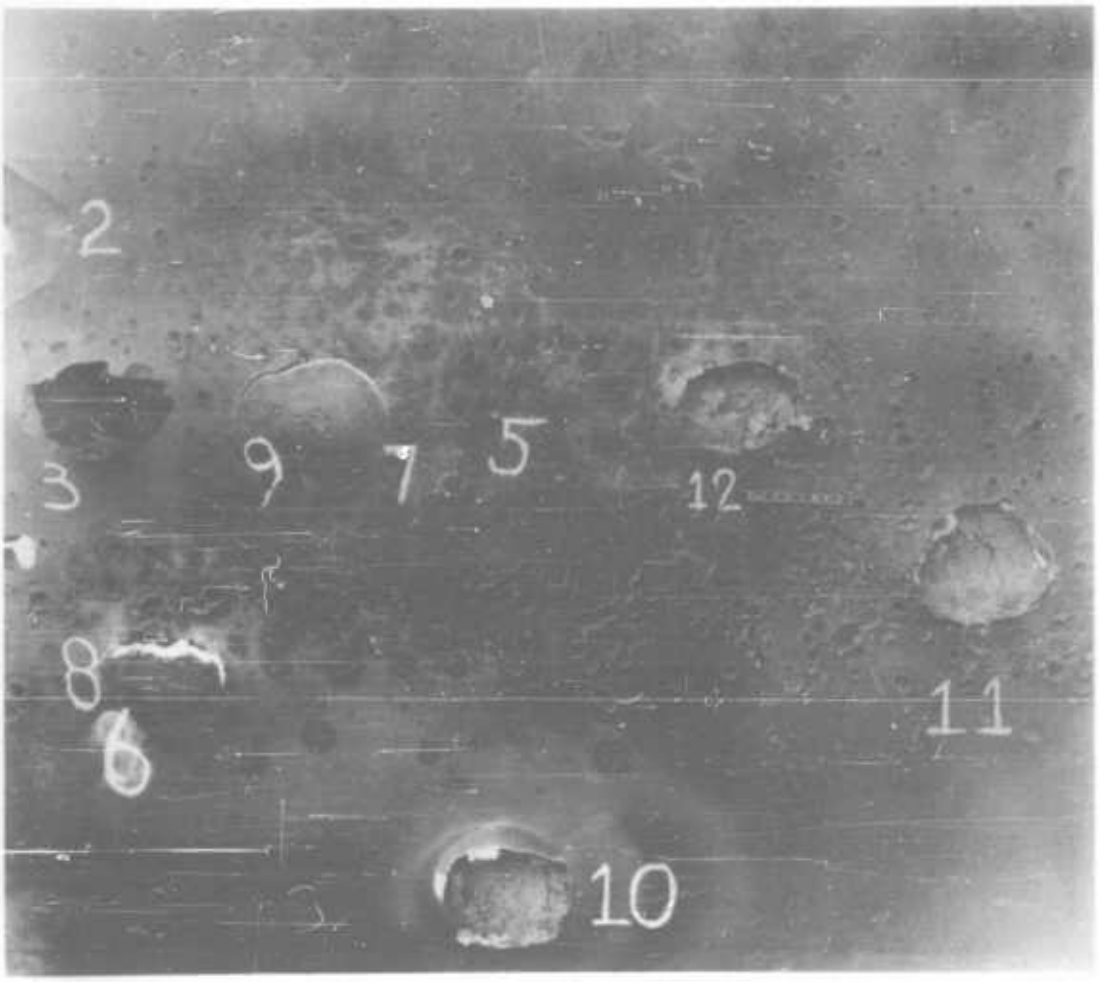
B24759: Rear view of Turret, M36 Gun Motor Carriage, showing damage. Arrow indicates point of hit by Shell, HEP, 155mm, T152E6.



B24760: View of motor compartment, M36 Gun Motor Carriage, showing damage caused by Shell, HEP, 155mm, T152E6.



B25724: Front view of 7-inch plate fired at 1000 yards, 60° obliquity - showing ten hits on plate which had a charpy value of 103/91, BHN 235/232. Round Nos. 1 and 4 missed the plate. Round No. 8 was low order.



B25725: Rear view of 7-inch plate fired at 1000 yards, 60° obliquity - showing ten hits on plate which had a charpy value of 103/91, BHN 235/232.

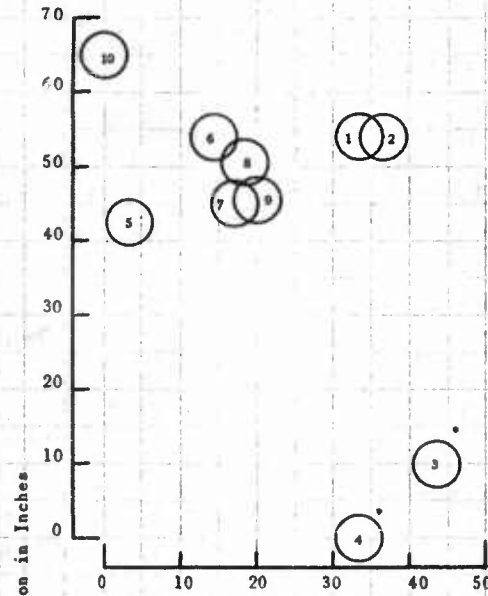
B25726: Rear view of 7-inch plate fired at 1000 yards, 60° obliquity - showing back spall of Round 10, depth of spall is 3/4 inch size of spall is 15" x 12". Interior of spall is laminated.

APPENDIX D

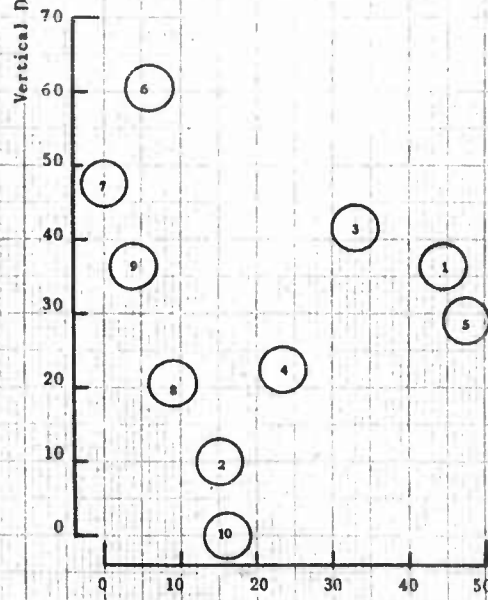
VERTICAL TARGET ACCURACY

Shell: HEP, 155mm, T152E5
Fired from: 155mm Howitzer M1

Date fired: 10 April 57
Range: 999.45 yards



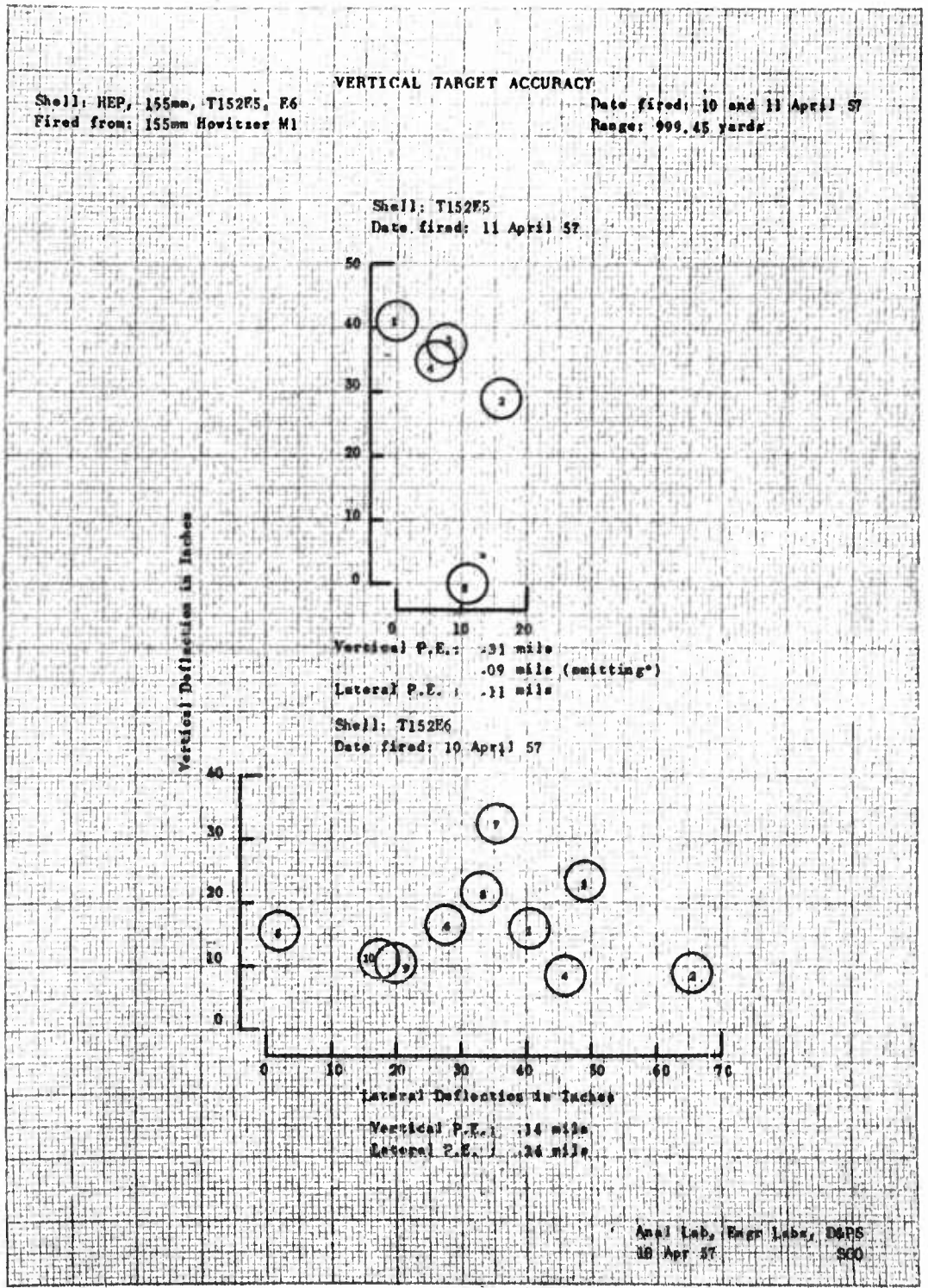
Vertical P.E.: .39 mils
.13 mils(omitting 9's)
Lateral P.E. : .27 mils



Lateral Deflection in Inches

Vertical P.E.: .34 mils
Lateral P.E. : .32 mils

Anal Lab, Engr Labs, D&PS
18 Apr 57 SCO


VERTICAL TARGET ACCURACY
Shell: HEP, 155mm, T152E5, E6
Fired from: 155mm Howitzer M1
Date fired: 10 and 11 April 57
Range: 999.45 yards
Shell: T152E5
Date fired: 11 April 57
Vertical P.E.: .31 mils
.09 mils (omitting *)
Lateral P.E. : .11 mils
Shell: T152E6
Date fired: 10 April 57
Vertical Deflection in Inches
Lateral Deflection in Inches
Vertical P.E.: .14 mils
Lateral P.E. : .16 mils
Anal Lab, Engr Labs, D&PS
18 Apr 57
SGO

ANALYTICAL LABORATORY REPORT APPENDIX E

TEST OF:

Shell, HEP, 155mm, T152E5 and T152E6.

OBJECT OF TEST:

To obtain vertical target accuracy and exterior ballistic coefficients.

Report No. 57-AL-46

Date Submitted 21 May 1957

Prepared for Mr. Ralph Allen, Artillery Ammunition Branch

Dates of Test 10 and 11 April 1957

Project No. TA1-5002H/TE20

Work Order No. 32-236-54

Sheet 1 of 1

Target accuracy and time of flight firings were conducted with Shells, HEP, 155mm, T152E5 and T152E6 to determine form factor and ammunition dispersion on 10 and 11 April 1957, with a vertical target placed at 1000 yards from the muzzle of the gun. The results of the firings are contained in the following table:

Shell	Avg Proj Wt. (lbs)	Date Fired (Apr 57)	No. of Rds	Instrument Velocity (fps) Avg	Std Dev	Pressure (psi/100) Avg	Std Dev	Time of Flight (sec)	Bal Coef (G_1)	Form Factor	Vertical Target Accuracy P.E. (mils) Vert.	Lat.
E5	70.55	10	10	1807	3.1	286	3.7	1.78623	2.03	.89	.39 .13[a]	.27
E5	70.52	10	10	1812	3.5	290	7.2	1.78117	2.02	.90	.34	.32
E6	77.83	10	10	1824	6.7	312	4.4	1.74858	2.27	.88	.14	.34
E5	70.62	11	5	-	-	292	3.6	-	-	-	.31 .09[b]	.11

a. Omitting two maverick rounds.
b. Omitting one maverick round.

Prepared by W. E. Cantey
W. E. Cantey

Reviewed by Joseph E. Steedman
Joseph E. Steedman
Technical Assistant
Propellant & Target Accuracy Section

Approved by A. E. Karp
A. E. Karp
Chief
Analytical Laboratory

Engineering Laboratories
Supporting Services
Development and Proof Services
Aberdeen Proving Ground, Maryland

ORDBG-677
Rev 25 Sept 52

Ordnance Corps
Aberdeen Proving Ground
Maryland

SUMMARY OF METEOROLOGICAL DATA

Program: 155mm Howitzer

Proof Officer: Mr. Allen

Date 24 June 1957

Time 0929 to 1143
1335 to 1408

WINDS ALOFT

Balloon Run No.	Time of Release	Max. Ordinate Required (Ft.)	Max. Ordinate Reached (Ft.)
2 R	0934	15,000	15,000
3 R	1030	15,000	14,154
4 R	1157	15,000	15,000
5 R	1331	15,000	15,000
6 R	1430	15,000	15,000

DENSITIES ALOFT

Radio Metro Run No.	Time of Release	Max. Ordinate Required (Ft.)	Max. Ordinate Reached (Ft.)
2 R	0934	15,000	15,000
3 R	1030	15,000	14,604
5 R	1331	15,000	15,000
6 R	1430	15,000	15,000

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Ordnance Corps
ABERDEEN PROVING GROUND, MD.
METEOROLOGICAL SERVICE

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Program 155mm Howitzer

Proof Off. Mr. Allen

Date 24 June 1957

Ascension No.: 2 R

Time: 0934

Method Used: GMD-1

Az. Line of Fire: 39°00'

WIND DATA ALOFT

Time Observed Mins.	Altitude yds.	W_x m.p.h.	W_z m.p.h.
0	0	- 7.7	-2.2
1	332	- 5.0	+1.2
2	750	- 3.0	+4.0
3	1148	- 3.7	+6.7
4	1514	- 6.2	+7.0
5	1908	- 8.5	+6.2
6	2304	-12.4	+2.3
7	2719	-13.9	-2.5
8	3128	-14.9	-2.7
9	3547	-16.0	-3.2
10	3964	-14.5	-4.9
11	4354	-11.2	-7.8
12	4750	-10.4	-7.4
13	5163	-11.1	-4.6
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SURFACE DATA

Sky: Scattered Clouds	Temperature: 77.8 of	Wind Direction (To) 235
Visibility: 7 miles	Pressure 30.04 in	Wind Velocity M.P.H.
Disappearance: Abandoned	Relative Humidity 81 %	8
	Ballistic Density .977	

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Ordnance Corps
ABERDEEN PROVING GROUND, MD.
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Program 155mm Howitzer

Proof Off. Mr. Allen

Date 24 June 1957

Ascension No.: 24 June 1957

Time: 1030

Method Used: 155mm Howitzer

Az. Line of Fire: 39°00'

WIND DATA ALOFT

Time Observed Mins.	Altitude yds.	W_x m.p.h.	W_z m.p.h.
0	0	- 7.3	+3.3
1	392	- 4.2	+3.2
2	746	- 4.0	+6.5
3	1077	- 6.6	+6.7
4	1426	-10.8	+5.1
5	1820	-11.8	+3.6
6	2146	-11.5	+0.6
7	2532	-13.3	-2.3
8	2904	-14.3	-4.3
9	3258	-16.0	-4.7
10	3618	-15.5	-5.2
11	3996	-12.6	-5.2
12	4346	-12.4	-4.8
13	4718	-12.8	-4.8
14			
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SURFACE DATA

Sky: Scattered Clouds	Temperature: 83.0 of	Wind Direction (To) 195
Visibility: 7 miles	Pressure 30.05 in	Wind Velocity M.P.H.
Disappearance: Instrument failure	Relative Humidity 69 %	8
	Ballistic Density .968	

ARMY ... ABERDEEN PROVING GROUND, MD.

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ABERDEEN PROVING GROUND, MD.
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Program 155mm Howitzer

Proof Off. Mr. Allen

Date 24 June 1957

Ascension No.:	Time:
4 R	1157
Method Used:	Az. Line of Fire:
GMD-1	39°00'

WIND DATA ALOFT

Time Observed Mins.	Altitude yds.	W_x m.p.h.	W_z m.p.h.
0	0	- 2.9	+ 4.0
1	365	M*	M
2	719	M	M
3	1092	M	M
4	1410	M	M
5	1755	M	M
6	2103	M	M
7	2452	-14.7	- 0.6
8	2800	-12.4	- 2.0
9	3152	-12.8	- 3.1
10	3490	-15.1	- 4.5
11	3832	-16.9	- 5.5
12	4191	-16.7	- 3.5
13	4537	-13.6	+ 0.2
14	4880	-12.3	- 1.1
15	5236	-11.7	+ 0.5
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* Instrument tracking failure precluded accurate observation at lower levels of sounding.

SURFACE DATA

Sky: Scattered Clouds	Temperature: 85.0 of	Wind Direction (To) 165
Visibility: 5 miles	Pressure 30.02 in	Wind Velocity M.P.H.
Disappearance: Abandoned	Relative Humidity 66 %	5
	Ballistic Density .963	

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Ordnance Corps
ABERDEEN PROVING GROUND, MD.
METEOROLOGICAL SERVICE

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Program 155mm Howitzer

Proof Off. Mr. Allen

Date 24 June 1957

Ascension No.: 5 R

Time: 1331

Method Used: GMD-1

Az. Line of Fire: 39°00'

WIND DATA ALOFT

Time Observed Mins.	Altitude yds.	W_x m.p.h.	W_z m.p.h.
0	0	- 7.9	+1.3
1	409	-13.3	+2.8
2	741	-12.5	+7.6
3	1102	-13.1	+7.0
4	1445	-15.3	+5.4
5	1753	-16.9	+3.0
6	2079	-16.5	+0.2
7	2351	-15.3	-1.6
8	2672	-12.1	-3.3
9	2982	- 9.8	-2.9
10	3313	-11.5	-3.0
11	3591	-13.4	-2.1
12	3915	-13.5	-2.0
13	4268	-13.8	-1.7
14	4620	-12.4	+0.1
15	4973	- 9.7	+0.4
16	5333	-10.2	+0.6
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SURFACE DATA

Sky: Scattered Clouds	Temperature: 87.0 of	Wind Direction (To) 210
Visibility: 5 miles	Pressure 30.00 in	Wind Velocity M.P.H.
Disappearance: Abandoned	Relative Humidity 60 %	8
	Ballistic Density .959	

ARMY---OS---ABERDEEN PROVING GROUND, MD--506

ORDBG-569
Rev. 25 May 46

Ordnance Corps
ABERDEEN PROVING GROUND, MD.
METEOROLOGICAL SERVICE

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Program 155mm Howitzer

Proof Off. Mr. Allen

Date 24 June 1957

Ascension No.:	Time:
6 R	1430
Method Used:	Az. Line of Fire:
GD-1	39°00'

WIND DATA ALOFT

Time Observed Mins.	Altitude yds.	W_x m.p.h.	W_z m.p.h.
0	0	-10.0	-0.2
1	460	-16.1	+4.5
2	828	-18.1	+6.4
3	1238	-19.5	+4.3
4	1586	-18.7	+2.3
5	1954	-16.8	+0.4
6	2370	-14.8	-1.0
7	2827	-11.1	-1.5
8	3204	-10.1	-1.4
9	3653	-12.6	-1.1
10	4045	-14.8	-0.3
11	4470	-14.0	+2.2
12	4881	- 8.9	+3.5
13	5298	- 8.6	+0.5
14			
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SURFACE DATA

Sky:	Temperature:	of	Wind Direction (To)
Scattered Clouds	87.4		220
Visibility: 5 miles	Pressure 29.98	in	Wind Velocity M.P.H.
Disappearance:	Relative Humidity 63	%	10
	Ballistic Density .957		

ARMY---OS---ABERDEEN PROVING GROUND, MD--506

Development & Proof Services
Aberdeen Proving Ground, Md.

TEMPERATURES AND DENSITIES ALOFT

Program 155mm Howitzer	Date 24 June 1957
Proof Director Mr. Allen	Radio Meteorograph Run Number 2 R
Time Released 0934	Time Reached Altitude 0947

ALTITUDE YARDS	TEMPERATURE °F	RELATIVE DENSITY
0	77.8	.977
190	71	.989
383	69	.990
579	69	.988
779	68	.989
983	68	.987
1191	66	.990
1402	63	.993
1618	60	.998
1836	58	.998
2060	55	1.000
2287	54	1.000
2520	51	1.001
2757	48	1.006
2999	45	1.008
3247	42	1.009
3500	40	1.009
3759	39	1.008
4025	37	1.006

Development & Proof Services
Aberdeen Proving Ground, Md.

TEMPERATURES AND DENSITIES ALOFT

Program 155mm Howitzer	Date 24 June 1957
Proof Director Mr. Allen	Radio Meteorograph Run Number 2 R
Time Released 0934	Time Reached Altitude 0947

ALTITUDE YARDS	TEMPERATURE °F	RELATIVE DENSITY
4298	35	1.007
4579	32	1.008
4867	29	1.008
5163	28	1.003

Development & Proof Services
Aberdeen Proving Ground, Md.

TEMPERATURES AND DENSITIES ALOFT

Program: 155mm Howitzer	Date: 24 June 1957
Proof Director: Mr. Allen	Radio Meteorograph Run Number: 3 R
Time Released: 1030	Time Reached Altitude: 1043

ALTITUDE YARDS	TEMPERATURE °F	RELATIVE DENSITY
0	83.0	.968
192	77	.979
386	70	.991
582	69	.991
782	68	.989
986	69	.987
1194	67	.989
1406	64	.991
1621	61	.995
1840	57	1.001
2063	56	1.000
2291	54	1.001
2523	52	1.001
2760	48	1.006
3002	46	1.008
3250	43	1.009
3503	40	1.010
3761	37	1.012

Development & Proof Services
Aberdeen Proving Ground, Md.

TEMPERATURES AND DENSITIES ALOFT

Program 155mm Howitzer	Date 24 June 1957
Proof Director Mr. Allen	Radio Meteorograph Run Number 3 R
Time Released 1030	Time Reached Altitude 1043

ALTITUDE YARDS	TEMPERATURE °F	RELATIVE DENSITY
4027	38	1.006
4300	35	1.007
4580	32	1.008
4868	29	1.008

Development & Proof Services
Aberdeen Proving Ground, Md.

TEMPERATURES AND DENSITIES ALOFT

Program: 155mm Howitzer	Date: 24 June 1957
Proof Director: Mr. Allen	Radio Meteorograph Run Number: 5 R
Time Released: 1331	Time Reached Altitude: 1349

ALTITUDE YARDS	TEMPERATURE °F	RELATIVE DENSITY
0	87.0	.959
194	82	.965
391	79	.971
591	77	.973
794	74	.976
1001	71	.981
1210	69	.983
1424	67	.986
1641	65	.986
1863	63	.988
2089	60	.992
2319	57	.995
2553	55	.997
2792	51	1.001
3037	48	1.002
3286	45	1.006
3540	42	1.006
3802	41	1.005

Development & Proof Services
Aberdeen Proving Ground, Md.

TEMPERATURES AND DENSITIES ALOFT

Program 155mm Howitzer	Date 24 June 1957
Proof Director Mr. Allen	Radio Meteorograph Run Number 5 R
Time Released 1331	Time Reached Altitude 1347

ALTITUDE YARDS	TEMPERATURE °F	RELATIVE DENSITY
4070	39	1.004
4345	36	1.006
4627	36	1.001
4918	33	1.002
5217	30	1.003

Development & Proof Services
Aberdeen Proving Ground, Md.

TEMPERATURES AND DENSITIES ALOFT

Program 155mm Howitzer	Date 24 June 1957
Proof Director Mr. Allen	Radio Meteorograph Run Number 6 R
Time Released 1430	Time Reached Altitude 1443

ALTITUDE YARDS	TEMPERATURE °F	RELATIVE DENSITY
0	87.4	.957
194	80	.969
391	80	.970
591	77	.972
794	74	.976
1000	72	.980
1210	70	.981
1424	67	.985
1641	64	.988
1862	61	.992
2087	58	.995
2317	55	.998
2550	53	.999
2790	51	.999
3034	49	1.001
3284	46	1.001
3540	46	.999
3802	42	1.002
4071	41	1.001
4347	38	1.003
4630	36	1.002

Development & Proof Services
Aberdeen Proving Ground, Md.

TEMPERATURES AND DENSITIES ALOFT

Program: 155mm Howitzer	Date: 24 June 1957
Proof Director: Mr. Allen	Radio Meteorograph Run Number: 6 R
Time Released: 1430	Time Reached Altitude: 1443

ALTITUDE YARDS	TEMPERATURE °F	RELATIVE DENSITY
4921	33	1.001
5220	29	1.003

ENGINEERING LABORATORIES
PHYSICAL TEST LABORATORY REPORT

ORDBG-DP-LP

TITLE:

Metallurgical and Chemical Analysis of Armor from German Royal Tiger Tank Hull.

OBJECT OF TEST:

To determine physical properties, metallurgical structure, and chemical composition of the 6" armor.

Report No. 57-P-45

Sheet 1 of 3

Date of Test 18 June - 26 July 1957

Report Completed 7 August 1957

Conducted for Mr. R. Allen, Artillery Division

Project No. TA1-5002H/TE20

References Military Specification MIL-A-12560 (Ord)

INTRODUCTION:

The project engineer requested that these tests be conducted on a section of hull armor from the upper front plate of a German Royal Tiger tank hull. These hulls were shipped to APG from the factory where they were captured near the end of World War II. They have been used in various tests where armor was desired, but no particular quality was required. A test has been conducted recently, however, in which performance of a round is being evaluated, and the question arose as to the quality of the armor in the hull. Since no data on this armor was available, the metallurgical and chemical analyses were requested.

TEST PROCEDURE:

1. A section approximately 15" square was flame cut from the upper front plate. Cross-sectional plates were sawed from this section, at right angles to each other, for a macroetch test to determine the major direction of rolling. These were designated "X" and "Y" and were selected at least 4" from any flame-cut surface. The plates were given a hot acid macroetch in 50% HCl.

2. Three standard Charpy "V" Notch Specimens and one standard 0.505" diameter tensile bar were machined from each of the above plates and designated as "X" and "Y", according to the plate from which machined (see photographs, Appendix II for location of test specimens). Tensile and Charpy impact data were obtained. Brinell hardness readings were taken through the cross-section of each plate.

3. Specimens were mounted in bakelite, polished, etched and examined under high magnification. Photomicrographs are included in Appendix II.

4. Drillings were obtained through the cross-section of the armor and sent to the Coating and Chemical Laboratory for the chemical analysis.

RESULTS:

1. The macroetched plates showed the armor to be free of large laminations, seams, cracks, porosity, or other serious macro-defects. The plate appeared to be cross-rolled but the major direction of rolling could not be determined, since both directions had about the same appearance. The relatively intact dendritic structure indicates that working was not severe (see photographs, Appendix II).

2. Mechanical test data follows:

a. Charpy "V" Notch Impact Data

Spec. No.	Breaking Temp, °F	Energy Absorbed ft-lbs	Fracture Appearance*
Y1	70	35.0	40S, 60C
X1	70	28.5	30S, 70C
Y2	-40	7.0	100C
X2	-40	5.0	100C
Y3	200	42.0	50S, 50C
X3	200	43.0	50S, 50C

* "S" denotes shear; "C" denotes cleavage type of fracture.

b. Tensile Test Data (See Appendix I for Stress-Strain Curves)

Spec. No.	Yield Strength (.1% offset, psi)	Tensile Strength psi	% Elong. in 2"	% Reduction in Area
X	89,500	118,250	19.5	53.7
Y	89,000	118,000	21.0	56.3

c. BHN, 3000 Kg

Spec. No.	No. Readings	Range	Average
X	6	235-255	248
Y	6	241-255	244

3. Viewing the microsample in the unetched condition revealed this armor to be clean and largely free from non-metallic inclusions. A few scattered, elongated inclusions were noted, probably of MnS. The etched samples showed the microstructure to be fairly coarse tempered martensite. Some

ferrite was present and fairly noticeable banding was present. (See photomicrographs, Appendix II).

4. Results of the Chemical Analysis follow:

Carbon	0.43%
Manganese	0.43
Silicon	0.33
Sulfur	0.019
Phosphorus	0.024
Nickel	0.14
Chromium	2.17
Molybdenum	0.22
Vanadium	0.01

DISCUSSION:

1. A comparison of the results of this analysis against the requirements of the current U.S. Military Specification for wrought armor leads to the following observations:

a. The armor tested is within the specification for hardness.

b. Carbon content is higher than the specified maximum.

c. Charpy impact values are far below those required for armor plate of this thickness and hardness.

2. Since the steel is clean, sound, and has enough alloy content to be in the armor class, it appears that the poor impact resistance largely results from the heat treatment. The presence of some high temperature transformation products, coarse structure, and fairly high carbon content contribute to the poor impact values.

CONCLUSION:

The plate investigated should be considered poor quality armor.

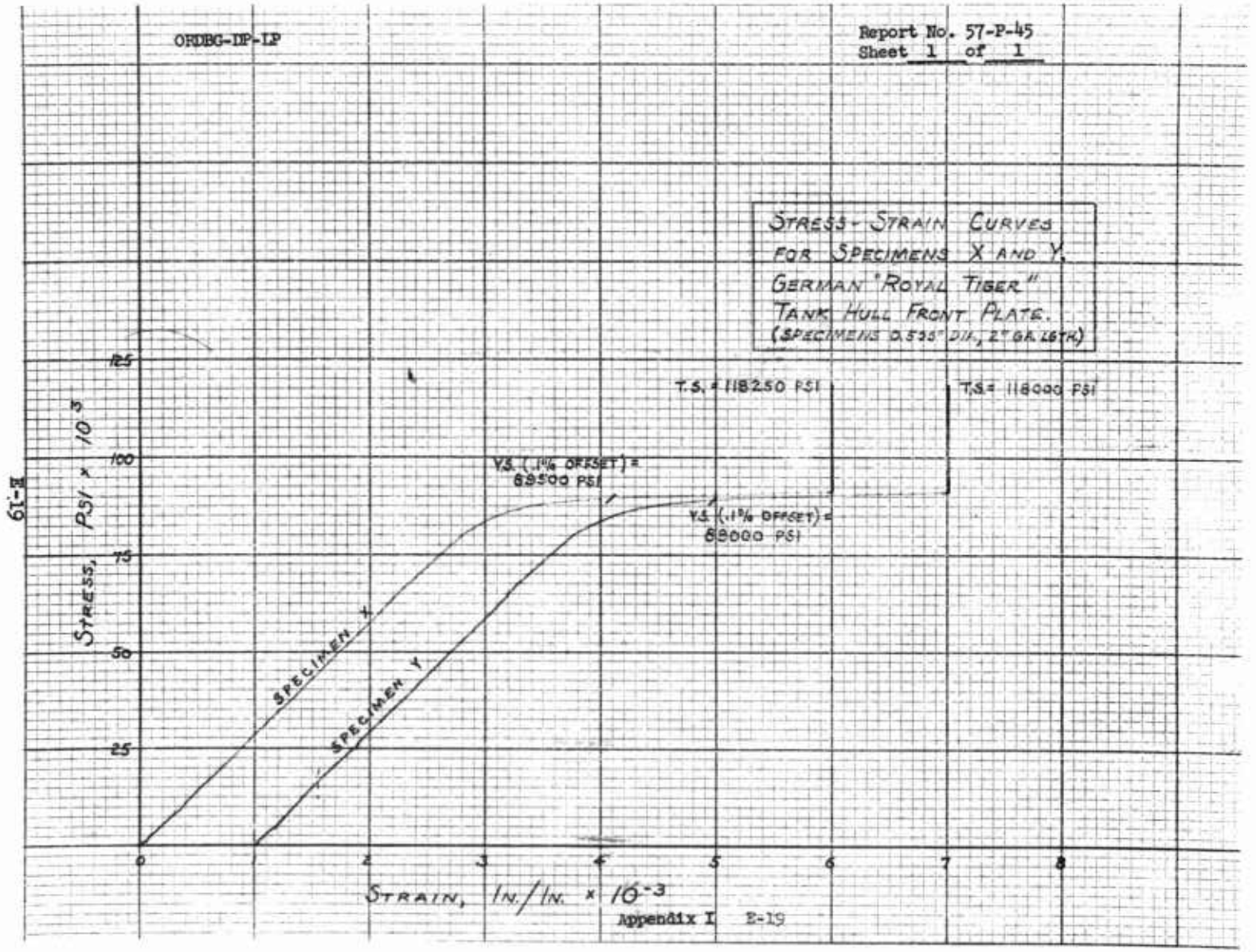
2 Incls.
Appendix I
Appendix II

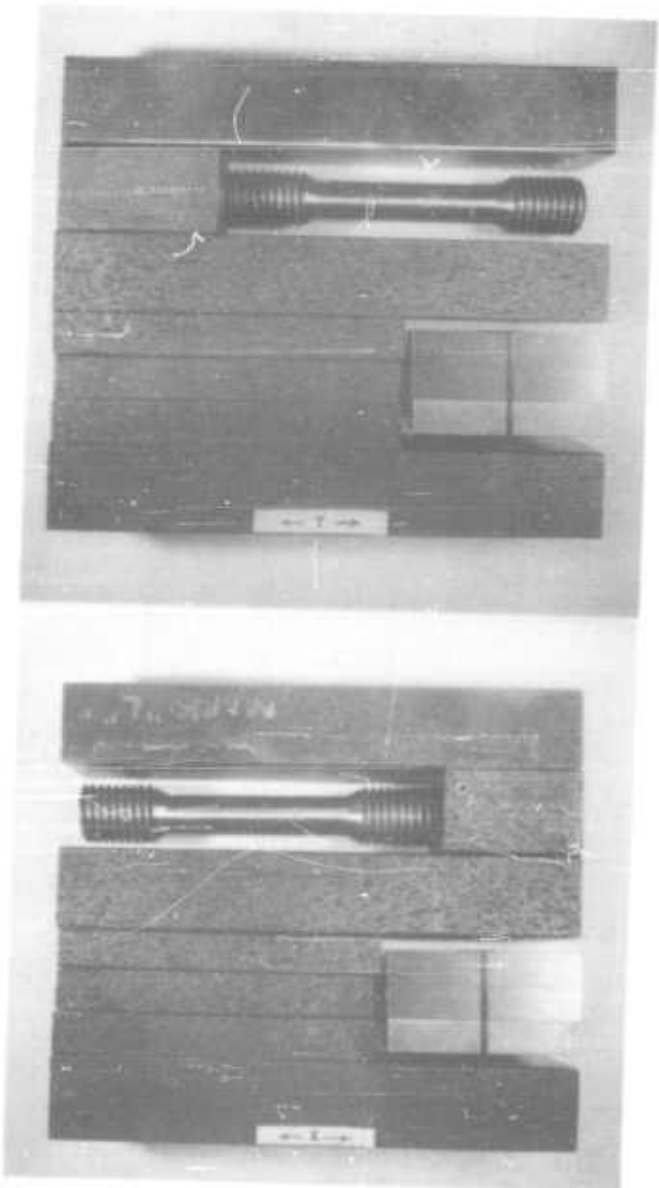
Approved: J. M. McKinley
J. M. McKinley,
Chief
Physical Test Laboratory

Signed: R. L. Huddleston
R. L. Huddleston,
Chief
Rad. & Met. Section

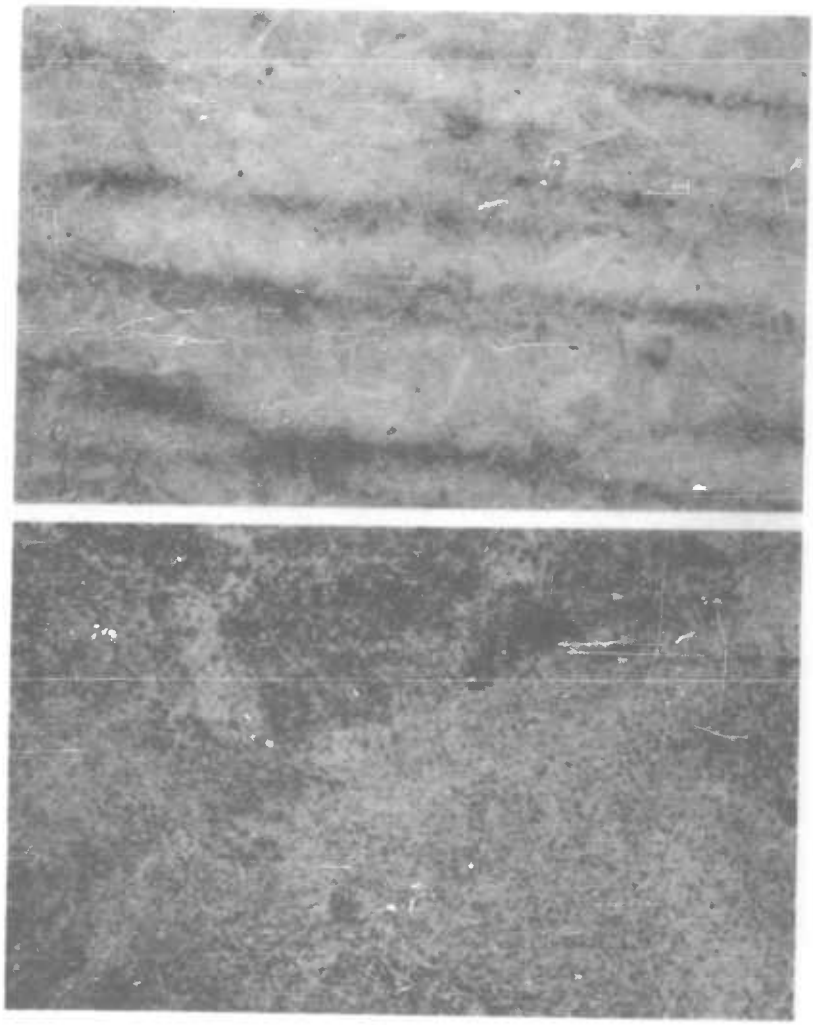
ORDBG-DP-LP

Report No. 57-P-45
Sheet 1 of 1





Approx. ½X. Macroetched "X" and "Y" cross-sections showing location of test specimens. "X" and "Y" sections were selected normal to each other.



Top: 250X (Picral Etch). Microstructure showing tempered structure, banding, and scattered inclusions.

Bottom: 750X (Picral Etch). Tempered martensitic structure.

ORDBG-859K (Reinst 22 Mar 55)

155 mm Howitzer Tube, M1

CASTING NUMBER	X
MANUFACTURER	WVT ARS
PROOF OFFICER	Mr. Hasson - W. O. 22-603-48
MODEL	M1
NUMBER OF ROUNDS	4506
NUMBER	[illegible]
FIRING STATUS (Check One)	BEFORE / AFTER ✓
155 Howitzer Tube	Mounted in Howitzer
DATE OF GAUGING	[illegible]

Main Bore - 29.70" to 142.80"

Distance (Inches) From			Gauge Meas. indicated in 1/1000 of an inch			
			LANDS 6.100" Basic Diameter		GROOVES 6.200" Basic Diameter	
Rear Face of Breech Howitzer	Muzzle Face Tube	Rear Face of Tube Tube	Vert.	Hor.	Vert.	Hor.
149.10	.10	142.70	+.003	+.003	+.003	+.003
148	1.20	141.60	2	2	3	3
147	2.20	140.60	2	2	4	3
145	4.20	138.60	2	2	4	3
140	9.20	133.60	2	2	4	3
135	14.20	128.60	2	2	4	3
130	19.20	123.60	2	3	4	4
125	24.20	118.60	2	3	4	4
120	29.20	113.60	2	3	4	4
115	34.20	108.60	2	3	4	4
110	39.20	103.60	[illegible]	3	4	4
105	44.20	98.60	[illegible]	[illegible]	5	4
100	49.20	93.60	[illegible]	4	5	4
95	54.20	88.60	4	4	5	4
90	59.20	83.60	[illegible]	4	5	4
85	64.20	78.60	[illegible]	5	5	4
80	69.20	73.60	5	5	5	4
75	74.20	68.60	[illegible]	5	5	4
70	79.20	63.60	[illegible]	5	5	4
65	84.20	58.60	[illegible]	5	5	4
60	89.20	53.60	[illegible]	5	5	[illegible]
54.40	94.80	48.00	[illegible]	[illegible]	5	[illegible]
50	99.20	43.60	[illegible]	[illegible]	5	4
48.30	100.90	41.90	[illegible]	[illegible]	5	4
46.	103.20	39.60	[illegible]	7	5	4
44	105.20	37.60	[illegible]	7	5	[illegible]
42.20	107.00	35.80	[illegible]	[illegible]	5	[illegible]
40	109.20	33.60	[illegible]	[illegible]	[illegible]	[illegible]
39.10	110.10	32.70	[illegible]	[illegible]	7	[illegible]
38.10	111.10	31.70	[illegible]	[illegible]	[illegible]	[illegible]
37.10	112.10	30.70	[illegible]	12	9	7
36.50	112.70	30.10	[illegible]	[illegible]	9	[illegible]
36.20	113.00	29.80	[illegible]	[illegible]	[illegible]	[illegible]

Pullover Meas.

	Vert	Horz
29.[illegible]"	.124"	6.129"

ORDBG-859K (Reinst 22 Mar 55) Part 2

155 mm Howitzer Tube, M1

CHAMBER 0.00" to 28.70" (BASIC)

DISTANCE (Inches) FROM REAR FACE OF BREECH	DISTANCE (Inches) FROM MUZZLE FACE	DISTANCE (Inches) FROM REAR FACE OF TUBE	BASIC DIAMETER	ZERO	GAUGE MEASUREMENTS INDICATED IN 1/1000 OF AN INCH — VERTICAL Y: GAUGE READING	VERTICAL Y: ACTUAL DIAMETER	VERTICAL Y: DIFFERENCE	HORIZONTAL X: GAUGE READING	HORIZONTAL X: ACTUAL DIAMETER	HORIZONTAL X: DIFFERENCE
35	114.20	28.60	6.2103		-.088	6.212	+.002	-.088	6.212	+.002
34	115.20	27.60	6.3107		+ 6	.306	- 5	+ 6	.305	- 5
33	116.20	26.60	6.4110		105	.405	6	105	405	6
32	117.20	25.60	6.5113		207	.507	4	207	507	4
31	118.20	24.60	6.6117	6.300"	306	.606	6	306	606	6
30.50	118.70	24.10	6.6618		356	656	6	356	656	6
30.10	119.10	23.70	6.693		+192	6.692	-.001	+.192	6.692	-.001
28	121.20	21.60	6.693		195	.695	+ 2	195	695	+ 2
26	123.20	19.60	6.693		195	695	2	195	695	2
24	125.20	17.60	6.693		195	695	2	195	695	2
22	127.20	15.60	6.693		196	696	3	196	696	3
20	129.20	13.60	6.693		196	696	3	196	696	3
18	131.20	11.60	6.693		196	696	3	196	696	3
16	133.20	9.60	6.693		196	696	3	196	696	3
14	135.20	7.60	6.693		196	696	3	196	696	3
12	137.20	5.60	6.693	6.500"	196	696	3	196	696	3
10	139.20	3.60	6.693		196	696	3	196	696	3
9	140.20	2.60	6.693		196	696	3	196	696	3
8	141.20	1.60	6.693		196	696	3	196	696	3
							Basic	Actual		
Opening between breech ring and rear face of tube					11 0'Clock		.000"	000		
					3 0'Clock		.000"	000		
					7 0'Clock		.000"	000		

SPECIAL MEASUREMENTS

	BASIC	ACTUAL		BASIC	ACTUAL
TOTAL LENGTH OF ~~XXXX~~Howitzer	149.20"	149.20"	ROTATION OF TUBE AT BREECH		--
TOTAL LENGTH OF TUBE			MOVEMENT OF TUBE AT BREECH		--
DEPTH OF BREECH RECESS	6.40"	6.40"	NUMBER OF LANDS AND GROOVES	48	48
Advance of Rifling (Plug Gauge)	.00"				

Inspection Remarks: Areas from 0" to .10", .10" to 1.399", (23.79" to 28.70"), and from 28.70" to 29.70" were not measured. Heat checking encircling origin and extending forward (approx) 10.00". Driving and non driving edges of lands encircling origin lightly rounded.

96%

STAMPED	STARGAUGED AND INSPECTED BY	REVIEWED BY
Prev. APG PA	Roope	
RODMAN Bevins	TIME	COMPILATOR
RECORDER Gurien	PLACE 525	GRAPHED BY

155m/m How Tube M1 No. 7 WVT ARS

20 Mar 1957 After Firing 4506

W. O. 22-603-46

ORDBG-859K (Reinst 22 Mar 55)

155 mm Howitzer Tube, M1

CASTING NUMBER:

MANUFACTURER: WT ARS — PROOF OFFICER: V. O. 32-236-54

MODEL: M1 — NUMBER OF ROUNDS: 461.7

NUMBER: No stamping on tube — 7

FIRING STATUS (Check One): BEFORE / AFTER

155 Howitzer Tube

Mounted in Howitzer

DATE OF GAUGING: 22 May 1957

Main Bore - 29.70" to 142.80"

Gauge Meas. indicated in 1/1000 of an inch

Distance (Inches) From Rear Face of Breech Howitzer	Distance (Inches) From Muzzle Face Tube	Distance (Inches) From Rear Face of Tube	LANDS 6.100" Basic Diameter Vert.	LANDS 6.100" Basic Diameter Hor.	GROOVES 6.200" Basic Diameter Vert.	GROOVES 6.200" Basic Diameter Hor.
149.10	.10	142.70	∠.005	∠.003	∠.003	∠.003
148	1.20	141.60	3	5	3	3
147	2.20	140.60	3	2	3	3
145	4.20	138.60	3	2	3	3
140	9.20	133.60	3	2	3	3
135	14.20	128.60	3	2	3	3
130	19.20	123.60	3	2	3	3
125	24.20	118.60	2	2	3	3
120	29.20	113.60	2	2	3	3
115	34.20	108.60	2	3	3	3
110	39.20	103.60	2	3	3	3
105	44.20	98.60	2	3	3	3
100	49.20	93.60	2	3	3	3
95	54.20	88.60	3	4	3	4
90	59.20	83.60	3	4	3	4
85	64.20	78.60	3	4	3	4
80	69.20	73.60	3	5	3	4
75	74.20	68.60	4	5	4	4
70	79.20	63.60	5	5	4	5
65	84.20	58.60	5	5	4	5
60	89.20	53.60	5	5	4	5
54.40	94.80	48.00	5	5	4	5
50	99.20	43.60	5	5	4	5
48.30	100.90	41.90	5	5	4	5
46.	103.20	39.60	5	6	5	5
44	105.20	37.60	5	6	5	5
42.20	107.00	35.80	5	6	5	5
40	109.20	33.60	5	7	5	5
39.10	110.10	32.70	6	7	6	6
38.10	111.10	31.70	6	9	7	7
37.10	112.10	30.70	12	12	7	8
36.50	112.70	30.10	18	21	8	8
36.20	113.00	29.80	∠.025	∠.025	∠.009	∠.009
			Pullover	Meas. Vert	Horz	
			29.80	6.125"	6.125"	

155mm/m How Tube M1 No.7 WTT ARS

22 May 1957 After Firing 4617 rounds

O. O. 32-236-54

ORDG-859K (Reinst 22 Mar 55) Part 2

155 mm Howitzer Tube, M1

CHAMBER 0.00" to 28.70" (BASIC)

DISTANCE (Inches) FROM REAR FACE OF BREECH	MUZZLE FACE	REAR FACE OF TUBE	BASIC DIAMETER	ZERO	GAUGE MEASUREMENTS INDICATED IN 1/1000 OF AN INCH VERTICAL X GAUGE READING	ACTUAL DIAMETER	DIFFERENCE	HORIZONTAL X GAUGE READING	ACTUAL DIAMETER	DIFFERENCE
35	114.20	28.60	6.2103		-.087	6.213	+.003	-.087	6.213	+.003
34	115.20	27.60	6.3107		+.009	.309	-.002	+.009	.309	-.002
33	116.20	26.60	6.4110		110	410	.001	.110	.410	.001
32	117.20	25.60	6.5113		212	513	+.002	.212	.513	+.002
31	118.20	24.60	6.6117		312	612	.000	.312	.612	.000
30.50	118.70	24.10	6.6618		+.362	662	.000	+.362	.662	.000
30.10	119.10	23.70	6.693	6.300"	+.393	6.693	.000	+.393	6.693	.000
28	121.20	21.60	6.693		396	.696	+.003	.396	.696	+.003
26	123.20	19.60	6.693		395	.695	.002	.395	.695	.002
24	125.20	17.60	6.693		395	.695	.002	.396	.696	.003
22	127.20	15.60	6.693		396	.696	.003	.396	.696	.003
20	129.20	13.60	6.693		396	.696	.003	.396	.696	.003
18	131.20	11.60	6.693		396	.696	.003	.396	.696	.003
16	133.20	9.60	6.693		396	.696	.003	.396	.696	.003
14	135.20	7.60	6.693		397	.697	.004	.397	.697	.004
12	137.20	5.60	6.693		397	.697	.004	.397	.697	.004
10	139.20	3.60	6.693		397	.697	.004	.397	.697	.004
9	140.20	2.60	6.693		397	.697	.004	.397	.697	.004
8	141.20	1.60	6.693		+.397	.697	.004	+.397	.697	.004

Opening between breech ring and rear face of tube		Basic	Actual
	11 O'Clock	.000"	.000"
	3 O'Clock	.000"	.000"
	7 O'Clock	.000"	.000"

SPECIAL MEASUREMENTS

	BASIC	ACTUAL		BASIC	ACTUAL
TOTAL LENGTH OF ~~xxx~~Howitzer	149.20"	149.20"	ROTATION OF TUBE AT BREECH		--
TOTAL LENGTH OF TUBE			MOVEMENT OF TUBE AT BREECH		--
DEPTH OF BREECH RECESS	6.40"	6.40"	NUMBER OF LANDS AND GROOVES	48	48
Advance of Rifling (Plug Gauge)	.00"				

Inspection Remarks: Areas from 0" to .10", .10" to 1.399", (23.79" to 28.70"), and from 28.70" to 29.70" were not measured. Borescoped: Light pits encircling entire chanber. Heat checking encircling origin and extending forward (approx) 18.00". Driving and non driving edges of lands encircling origin lightly rounded. Lands lightly coppered with light pits in grooves throughout muzzle half of bore.

95%

STAMPED (Proof) APG - PA	STARGAUGED AND INSPECTED BY Toope	REVIEWED BY
RODMAN Cunningham	TIME	COMPILATOR
RECORDER Curien	PLACE 525	GRAPHED BY

ARMY---BG---ABERDEEN PROVING GROUND, MD---673

ORDBG-859K (Reinst 22 Mar 55)

155 mm Howitzer Tube, M1

CASTING NUMBER:

MANUFACTURER: Watervliet Arsenal

PROOF OFFICER: W. O. 336-235-54

MODEL: M1

NUMBER OF ROUNDS: 1222

NUMBER: 2199

FIRING STATUS (Check One): BEFORE / AFTER

155 Howitzer Tube

Mounted in Howitzer

DATE OF GAUGING: 1 July 1957

Main Bore - 29.70" to 142.80"

Distance (Inches) From Rear Face of Breech Howitzer	Distance (Inches) From Muzzle Face Tube	Distance (Inches) From Rear Face of Tube Tube	Gauge Meas. indicated in 1/1000 of an inch — LANDS 6.100" Basic Diameter Vert.	LANDS 6.100" Basic Diameter Hor.	GROOVES 6.200" Basic Diameter Vert.	GROOVES 6.200" Basic Diameter Hor.
149.10	.10	142.70	+.001	+.002	+.005	+.005
148	1.20	141.60	1	2	5	5
147	2.20	140.60	1	1	5	5
145	4.20	138.60	1	1	5	5
140	9.20	133.60	1	1	5	5
135	14.20	128.60	1	1	5	5
130	19.20	123.60	1	1	5	5
125	24.20	118.60	1	1	5	5
120	29.20	113.60	1	1	5	5
115	34.20	108.60	1	1	5	5
110	39.20	103.60	1	1	5	5
105	44.20	98.60	1	1	5	5
100	49.20	93.60	1	1	5	5
95	54.20	88.60	1	1	5	5
90	59.20	83.60	1	1	5	5
85	64.20	78.60	1	1	5	5
80	69.20	73.60	1	1	5	5
75	74.20	68.60	1	1	5	5
70	79.20	63.60	1	1	5	5
65	84.20	58.60	1	1	5	5
60	89.20	53.60	1	1	5	5
54.40	94.80	48.00	1	1	5	5
50	99.20	43.60	2	1	5	5
48.30	100.90	41.90	2	2	5	5
46.	103.20	39.60	2	2	5	5
44	105.20	37.60	3	2	5	5
42.20	107.00	35.80	3	2	5	5
40	109.20	33.60	3	3	5	5
39.10	110.10	32.70	4	3	5	5
38.10	111.10	31.70	5	3	6	5
37.10	112.10	30.70	6	5	7	5
36.50	112.70	30.10	8	6	8	6
36.20	113.00	29.80	+.012	+.009	+010	+008

ORDBG-859K (Reinst 22 Mar 55) Part 2

155 mm Howitzer Tube, M1

CHAMBER 0.00" to 28.70" (BASIC)

DISTANCE (Inches) FROM REAR FACE OF BREECH	MUZZLE FACE	REAR FACE OF TUBE	BASIC DIAMETER	ZERO	VERTICAL Y GAUGE READING	VERTICAL ACTUAL DIAMETER	VERTICAL DIFFERENCE	HORIZONTAL X GAUGE READING	HORIZONTAL ACTUAL DIAMETER	HORIZONTAL DIFFERENCE
35	114.20	28.60	6.2103		-.067	6.213	+.003	-.007	6.213	+.003
34	115.20	27.60	6.3107		+.011	6.311	.000	+.011	6.311	.000
33	116.20	26.60	6.4110		.112	6.412	+.001	.112	6.412	+.001
32	117.20	25.60	6.5113		.211	6.511	.000	.211	6.511	.000
31	118.20	24.60	6.6117		.315	6.615	+.003	.315	6.615	+.003
30.50	118.70	24.10	6.6618		+.367	6.667	+.005	.367	6.667	+.005
30.10	119.10	23.70	6.693		+.393	6.693	.000	+.393	6.693	.000
28	121.20	21.60	6.693		.395	6.695	+.002	.395	6.695	+.002
26	123.20	19.60	6.693		.396	6.696	.003	.396	6.696	.003
24	125.20	17.60	6.693		.396	6.696	.003	.396	6.696	.003
22	127.20	15.60	6.693		.396	6.696	.003	.396	6.696	.003
20	129.20	13.60	6.693		.396	6.696	.003	.396	6.696	.003
18	131.20	11.60	6.693		.396	6.696	.003	.396	6.696	.003
16	133.20	9.60	6.693	6.396"	.396	6.696	.003	.396	6.696	.003
14	135.20	7.60	6.693		.396	6.696	.003	.396	6.696	.003
12	137.20	5.60	6.693		.396	6.696	.003	.396	6.696	.003
10	139.20	3.60	6.693		.396	6.696	.003	.396	6.696	.003
9	140.20	2.60	6.693		.396	6.696	.003	.396	6.696	.003
8	141.20	1.60	6.693		+.396	6.696	.003	+.396	6.696	+.003

Opening between breech ring and rear face of tube

	Basic	Actual
11 O'Clock	.000"	.000
3 O'Clock	.000"	.000
7 O'Clock	.000"	.000

Dist. - from R. Fc.	Pullover Meas. Vert	Horz
2980	6.111"	6.111"

SPECIAL MEASUREMENTS

	BASIC	ACTUAL		BASIC	ACTUAL
TOTAL LENGTH OF Howitzer	149.20"		ROTATION OF TUBE AT BREECH		
TOTAL LENGTH OF TUBE			MOVEMENT OF TUBE AT BREECH		
DEPTH OF BREECH RECESS	6.40"	6.40"	NUMBER OF LANDS AND GROOVES	48	48
Advance of Rifling (Plug Gauge)	.00"				

Inspection Remarks: Areas from 0" to .10", .10" to 1.399", (23.79" to 28.70"), and from 28.70" to 29.70" were not measured. Light rust pits and stanins encircling powder chamber. Moderate to light heat checking beginning (approx) 12.00" from rear face of tube in chamber and extending forward to (approx) 12.00" forward of origin of rifling. Two light longitudnal gouges beginning .75" rearward of origin and extending forward to origin at 6.00 O'clock. Gouge on edge of land at 5:00 O'clock, beginning .25" forward of origin and extending forward .50". Copper throughout tube. Life remaining 80%.

STAMPED (Prev) EPG-PA	STARGAUGED AND INSPECTED BY Booth	REVIEWED BY
RODMAN Shay	TIME	COMPILATOR
RECORDER Nevins	PLACE 525	GRAPHED BY

155m/m How Tube No. 2199 M1

1 July 1957 AF. 1222 rounds

W. O. 332-236-54

ARMY—OG—ABERDEEN PROVING GROUND, MD—673

ORDG--866 6 OCT 49 (FORMERLY SPOTZ--661)

METEOROLOGICAL SERVICE

DATE 10 April 1957

SURFACE DATA

155mm Howitzer — Mr. Allen

	MAXIMUM TEMPERATURE				MINIMUM TEMPERATURE			MEAN TEMPERATURE		
	TIME	WIND VEL. M.P.H.	WIND DIR. (From)	AZ.	WEATHER	VISIBILITY	TEMP. °F	SEA LEVEL PRESSURE IN. OF HG.	REL. HUM. %	RELATIVE DENSITY
1	0945	11	WNW	110	Clear	15+	53.1	30.07	44	1.033
2	1005	12	W	100	(Sctd) Thin Clds.	15+	52.6	30.07	40	1.035
3	1016	11	WSW	070	(Sctd) Thin Clds.	15+	52.8	30.07	39	1.034
4	1025	8	WSW	070	(Sctd) Thin Clds.	15+	52.5	30.06	40	1.034
5	1030	9	WSW	070	(Sctd) Thin Clds.	15+	52.6	30.06	40	1.034
6	1035	14	WSW	070	Sctd clds	15+	53.5	30.06	39	1.032
7	1105	10	SSW	025	Sctd clds	15+	55.0	30.06	37	1.029
8	1115	8	SSW	025	Sctd clds	15+	55.1	30.06	38	1.029
9	1120	15	WSW	070	Sctd clds	15+	55.6	30.06	36	1.028
10	1130	10	WSW	070	Sctd clds	15+	55.4	30.06	36	1.028
11	1140	10	WSW	070	Sctd clds	15+	55.4	30.05	37	1.028
12	1143	14	W	100	Sctd clds	15+	55.1	30.05	38	1.029
13	1145	12	NNW	155	Sctd clds	15+	55.2	30.05	38	1.028
14	1147	10	NNW	155	Sctd clds	15+	55.4	30.05	36	1.028
15	1150	18	NW	140	Sctd clds	15+	55.5	30.05	35	1.028
16	1152	10	NW	140	Sctd clds	15+	55.0	30.05	35	1.029
17	1155	8	WNW	110	Sctd clds	15+	55.2	30.05	34	1.028
18	1353	9	WNW	110	Sctd clds	15+	57.1	30.02	35	1.023
19	1400	10	W	100	Sctd clds	15+	57.2	30.02	33	1.023
20	1405	8	W	100	Sctd clds	15+	57.4	30.02	34	1.023
21	1406	9	W	100	Sctd clds	15+	57.2	30.02	33	1.023
22	1411	12	WNW	110	Sctd clds	15+	56.8	30.02	32	1.024
23	1420	18	WNW	110	Sctd clds	15+	56.6	30.02	31	1.025
24	1422	14	WNW	110	Sctd clds	15+	56.7	30.02	30	1.025
25	1424	12	WNW	110	Sctd clds	15+	56.5	30.02	31	1.025

ARMY---OS---ABERDEEN PROVING GROUND, MD.--148

ORDG--865 5 OCT 49 (FORMERLY SPCTZ--661)

METEOROLOGICAL SERVICE

DATE 10 April 1957

SURFACE DATA 155mm Howitzer

Mr. Allen

	MAXIMUM TEMPERATURE				MINIMUM TEMPERATURE			MEAN TEMPERATURE		
	TIME	WIND VEL. M.P.H.	WIND DIR. (From)	AZ.	WEATHER	VISIBILITY	TEMP. °F	SEA LEVEL PRESSURE IN. OF HG.	REL. HUM. %	RELATIVE DENSITY
26	1426	14	WNW	110	Sctd clds	15	57.1	30.02	31	1.024
27	1430	10	WNW	110	Sctd clds	15	56.7	30.02	32	1.025
28	1540	10	WNW	110	Sctd clds	15	56.8	30.03	32	1.025
29	1542	14	WNW	110	Sctd clds	15	57.0	30.03	32	1.025
30	1548	12	WNW	110	Sctd clds	15	56.4	30.03	34	1.025
31	1550	14	WNW	110	Sctd clds	15	56.2	30.03	34	1.025
32	1552	5	WNW	110	Sctd clds	15	56.0	30.03	35	1.026
33	1555	13	WNW	110	Sctd clds	15	56.1	30.03	34	1.026
34	1557	14	WNW	110	Sctd clds	15	56.5	30.03	34	1.025
35	1559	9	WNW	110	Sctd clds	15	56.7	30.03	35	1.024
36	1601	12	WNW	110	Sctd clds	15	56.8	30.03	36	1.024
37	1602	10	WNW	110	Sctd clds	15	56.4	30.03	37	1.025
38	1604	10	WNW	110	Sctd clds	15	56.7	30.03	37	1.024

ARMY---OS---ABERDEEN PROVING GROUND, MD--148

ORDG--855 5 OCT 49 (FORMERLY SPOTZ--651)

METEOROLOGICAL SERVICE

DATE: 11 April 1957

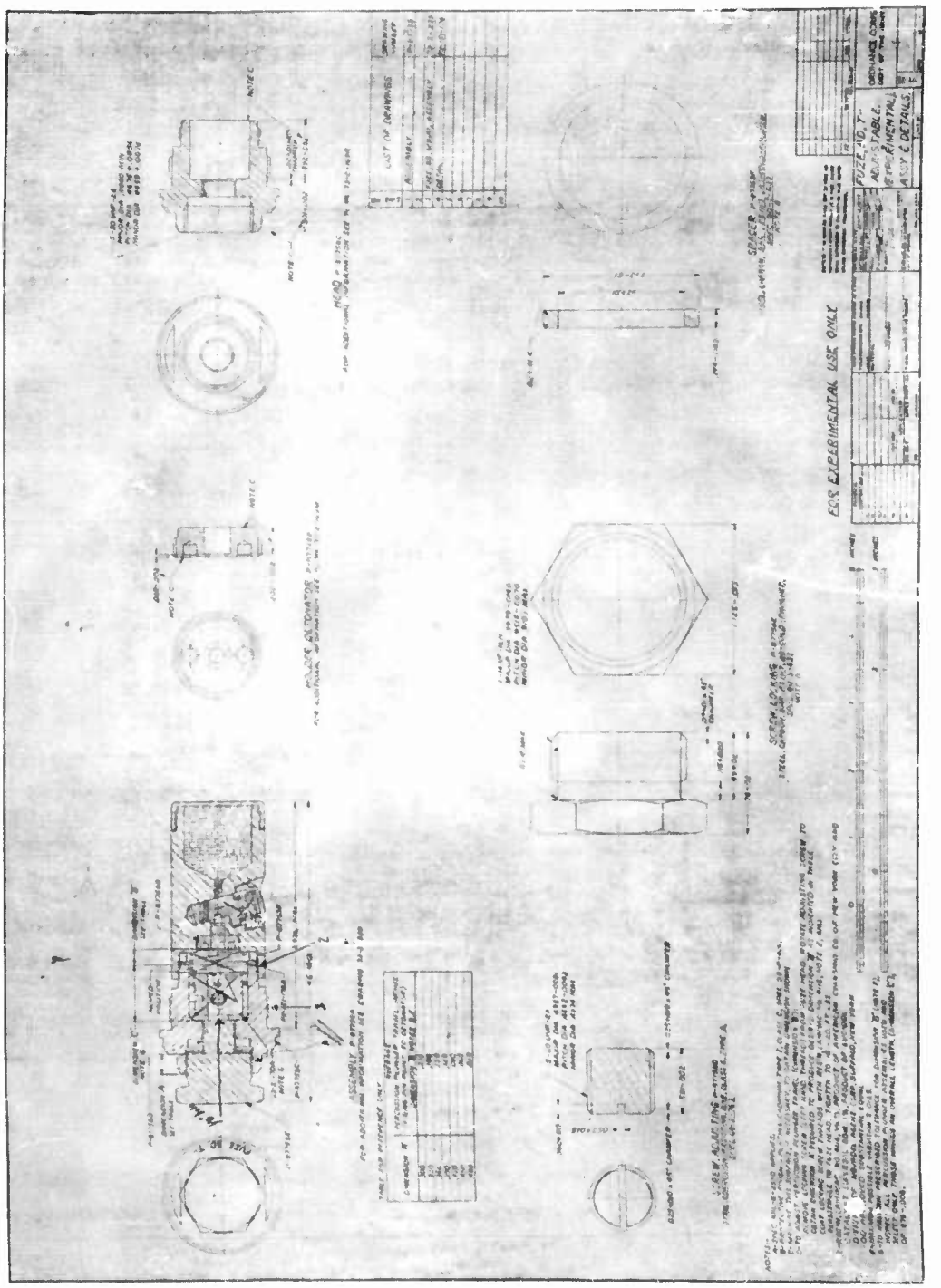
SURFACE DATA: 155mm Howitzer — Mr. Allen

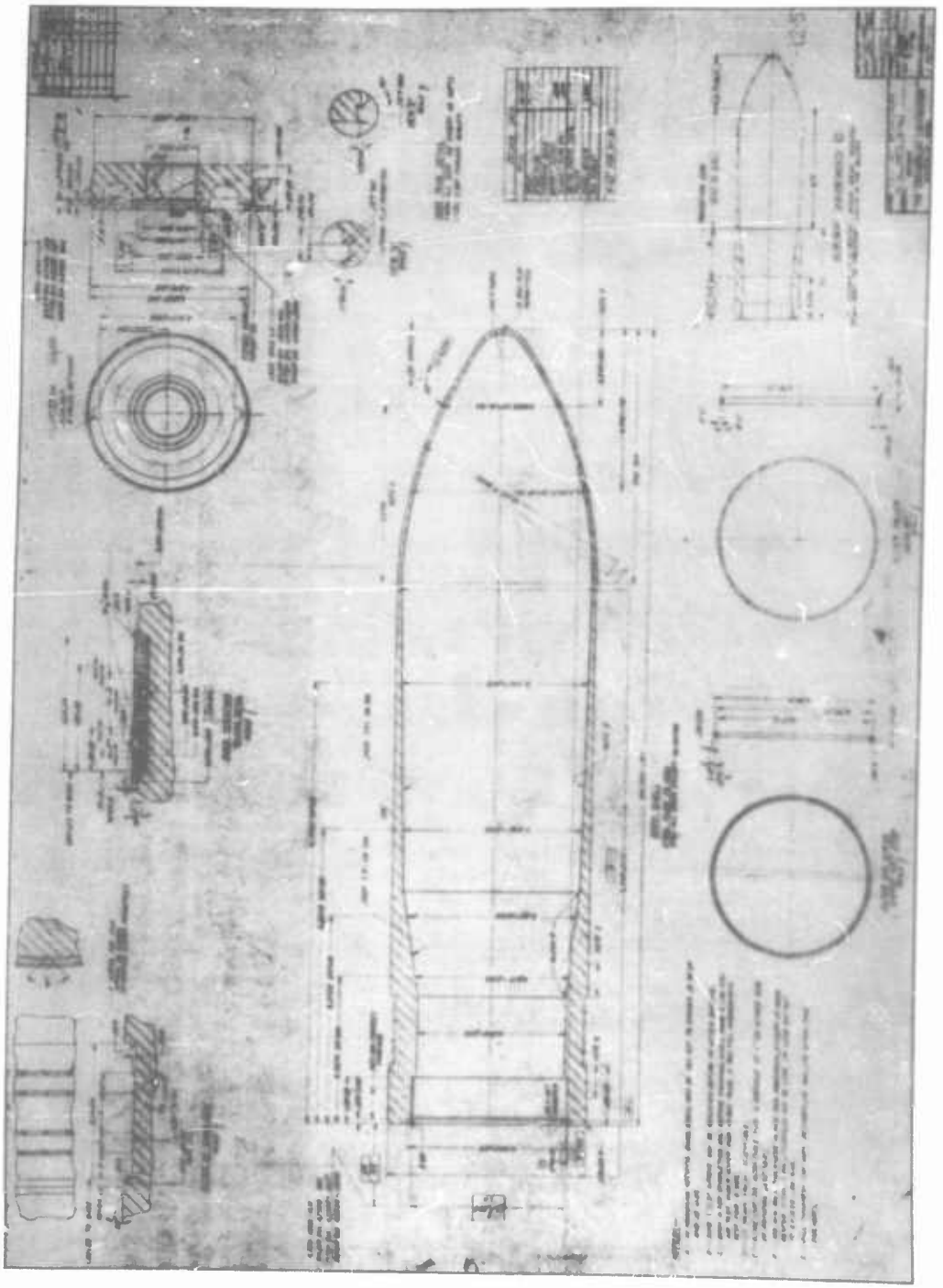
MAXIMUM TEMPERATURE | MINIMUM TEMPERATURE | MEAN TEMPERATURE

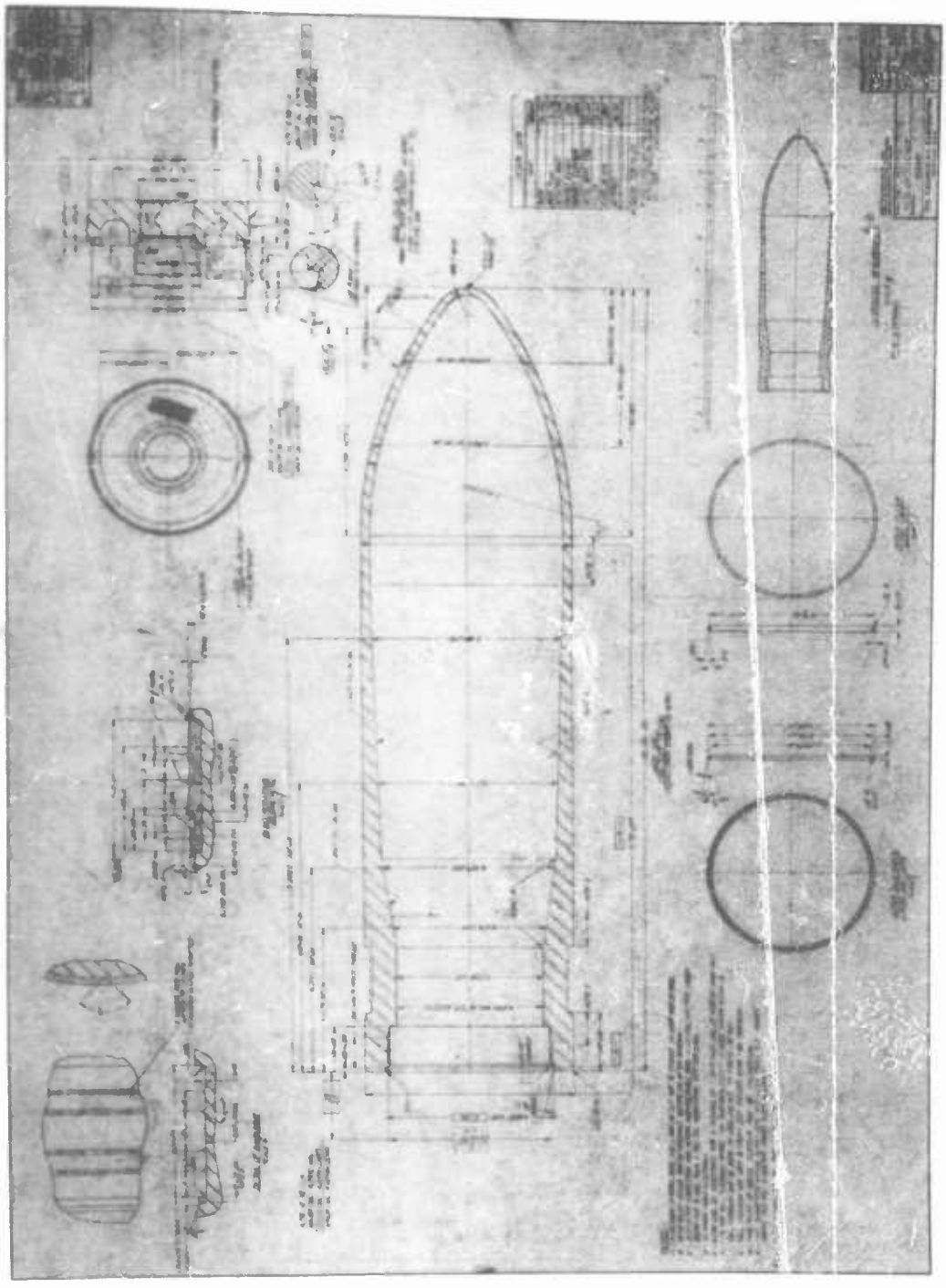
	TIME	WIND VEL. M.P.H.	WIND DIR. (From)	AZ.	WEATHER	VISIBILITY	TEMP. °F	SEA LEVEL PRESSURE IN. OF HG.	REL. HUM. %	RELATIVE DENSITY
1	1000	8	SSW	025	Clear	12	55.0	30.20	29%	1.034
2	1005	5	SSW	020	Clear	15	55.2	30.19	30%	1.033
3	1008	9	S	010	Clear	15	55.3	30.19	29%	1.034
4	1012	7	S	010	Clear	15	55.4	30.19	30%	1.034
5	1015	4	S	010	Clear	15	55.2	30.19	31%	1.033
6	1020	4	S	010	Clear	15	55.3	30.18	28%	1.034
7	1025	7	S	010	Clear	15	55.6	30.18	27%	1.033

ARMY---OS---ABERDEEN PROVING GROUND, MD--148

APPENDIX F







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